SCIENTIFIC AMERICAN

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SEABURY BREECH MECHANISM FOR RAPID FIRING AND OTHER GUNS.

For the past few years foreign military nations have been carrying on extensive experiments with quick firing guns of various calibers, from one inch to six inches, and their conclusions point to the adoption of a gun having a caliber between four and five inches as the one giving the most satisfactory results. In this country we have pinned our faith for the present, or

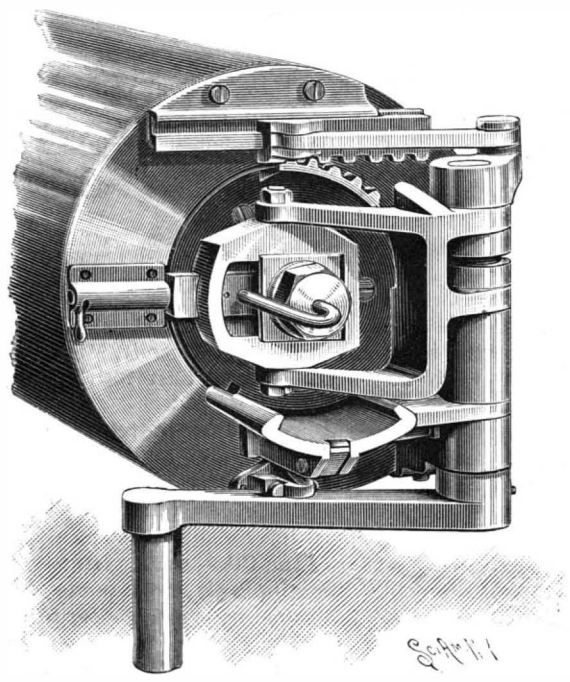

Fig. 1.—ORIGINAL DESIGN—REAR VIEW, MECHANISM CLOSED.

perhaps restricted our orders would be the better expression, at least as far as the naval branch of the service is concerned, to the four inch caliber as the extreme size of rapid fire gun, and several of that class of weapon are now in course of construction, and will be completed before the expiration of the present year. Facility for loading is, of course, a prime requisite of the quick fire type of guns, and in order to contribute to this result the projectile and powder should be contained in one cartridge, and be as light as is consistent with the necessary ballistic power. Metallic cartridges are used, and experiment has proved that the fixed ammunition cannot conveniently be handled when the caliber exceeds four inches. The cartridge then becomes so long and the weight so great that one man can no longer handle it with alacrity. The struggle, therefore, at present seems to have centered itself about the breech of the four inch gun, and with a view toward introducing mechanism at once strong, light, safe, and simple, Lieutenant Samuel Seabury, of the United States Navy, turned his attention, some two years since, to the subject, with the result as illustrated on these pages.

Figs. 1 and 2 represent in perspective the closed and open positions of the breech mechanism as originally designed. Figs. 3, 4, 5, and 6 are sections, etc., of the modified mechanism of the same type. Fig. 7 is rear view of modified type, having the handle and wiper combined, and Fig. 8 shows the method of handling by gearing the heavier calibers. Simple and ingenious as the original design, Figs. 1 and 2, appears in the modified form, Fig. 7, there is even greater simplicity, with a lessening of weight, increased strength, and a reduction in the number of parts. The breech plug is on the slotted screw system, that has already stood for many years the test of actual service, and which is, mechanically considered, the best known method for closing the breech of the gun. The points of resistance applied at three evenly divided parts of a circle, as in the slotted screw, are much nearer mechanical perfection than is attained by the side systems of closing the breech; besides which, the work of cutting the screw box is very much simpler. Greater length of bore is obtained for guns having the same external length, and hence greater power for the same weight of metal.

The feature of quick loading is also enhanced by the fact that it is not necessary to push the cartridge away forward to its seat before closing the breech. As much as seven inches of the cartridge can remain protruding from the seat, in the case of the four inch caliber, without interfering with the closing of the plug, which, upon being closed, shoves the cartridge forward to the firing position. The cartridge case extractors, as originally designed, consisted of a pair of spring-actuated hooks, as appears in Fig. 2, which, on closing the block, grasped the head of the cartridge, as is usually done in small arm systems.

A great improvement over this method has been made by the adoption of the extractors, as shown in Figs. 3, 5, and 6. This extractor consists of a plate sliding longitudinally in a recess at the bottom of the screw box, and having at its inner or forward end an upturned plate, so formed as to embrace a portion of the head of the cartridge, while a lug near this upturned portion, Figs. 5 and 6, serves to engage a corresponding recess at the forward end of the breech block, Figs. 4, 5, and 6. At the rear end of the extractor plate is a transverse slot engaging the upturned pin of the long arm of the extractor lever. The advantage of this method lies in the great power produced by the unscrewing of the breech block to loosen the empty cartridge case in the bore, while the rapid rearward motion imparted by the subsequent impingement of the mechanism against the short arm of this lever serves to eject the case effectively, as is done in the smaller types of rapid fire guns.

In the latest modifications of this mechanism the firing pin is made in one piece, and the coil spring around the firing pin, as shown in the illustrations, is replaced by a leaf spring secured to the retractor box. This renders unnecessary having so large a hole drilled in the center of the block for the firing pin.

Another improvement which will, no doubt, commend itself to ordnance men consists in changing the locking device from the handle of the mechanism to the rack which turns the block, thus reducing the number of parts through which the tendency to unlock on discharge acts. The new device consists of a strong pawl pivoted on the rear face of the gun, which by gravity drops into a recess on top of the rack when in the locked position.

To operate the mechanism as illustrated, grasp the handle, squeeze the movable plate in the handle so as to release the catch to unlock from the gun, and pull the breech plug around to the position indicated

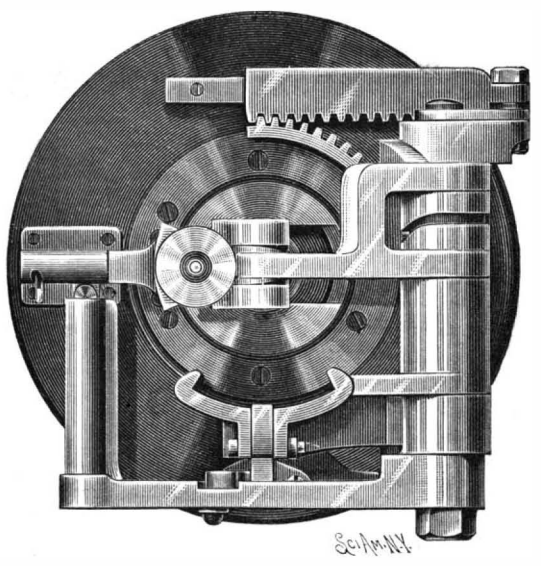

Fig. 3.—MODIFIED MECHANISM—REAR VIEW OF BREECH CLOSED.

in Fig. 5, where it stands clear of the bore of the gun, ready for the insertion of the cartridge. The various operations of unlocking the block, A, withdrawing it into the tray, N, and swinging the whole clear of the bore, are performed in this *one movement*, and herein lies one of the strongest points of the Seabury system, and one in which it possesses great advantages over the other metods in use with the slotted screw, as they require two and three motions to accomplish the same thing, sacrificing thereby some of that greatest of essentials in rapid firing systems, the element of time.

During the first 75° of the revolution of the handle, the wiper, E, acts upon a projection on the slide bar, D, Fig. 4, which, through the pin, M, pushes the rack, F, to the left on its guide, thereby turning the circular rack rigidly secured to the block, A, through an arc of 60°, unlocking it from the threads in the screw box of the gun. As soon as this is done, the shoulder on the wiper, E, comes in contact with the projection, H, on the retractor, G, and movement is imparted to it, thereby pulling the block to the rear into the tray, N, through the slipper guide acting in the horizontal slot cut in the retractor box, B, secured to the rear of the

(*Continued on page* 328.)

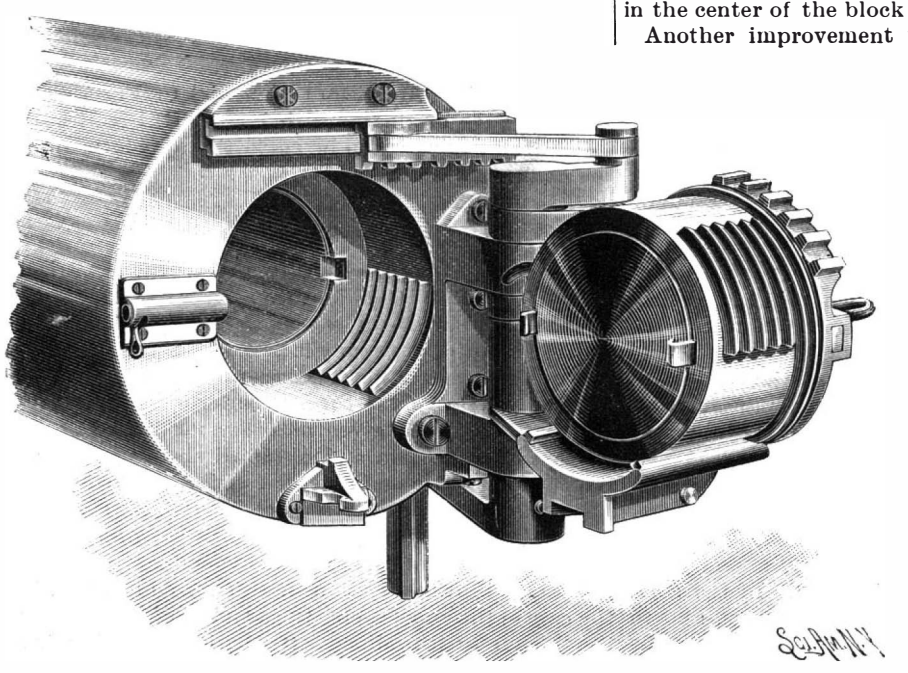

Fig. 2.—ORIGINAL DESIGN, BREECH OPEN.

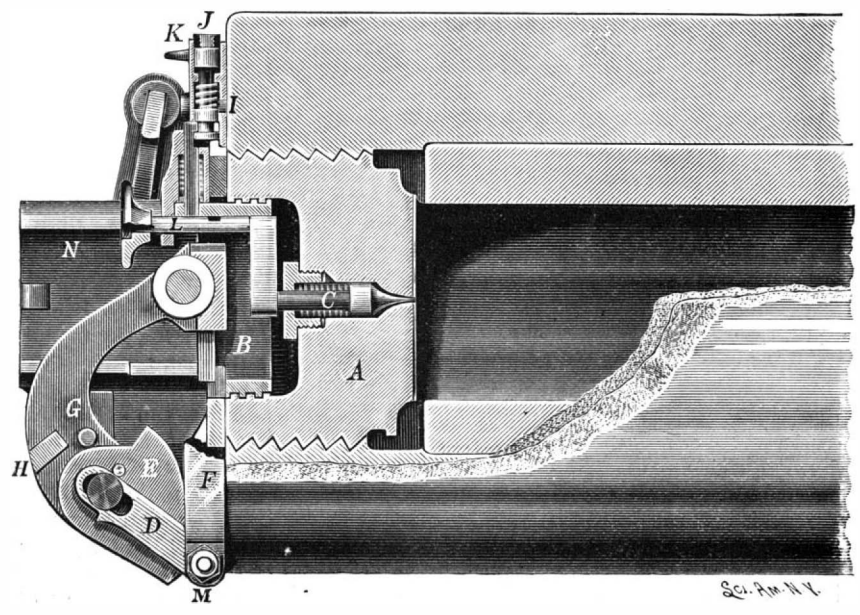

Fig. 4.—HORIZONTAL SECTION OF MODIFIED MECHANISM ON AXIS OF GUN.

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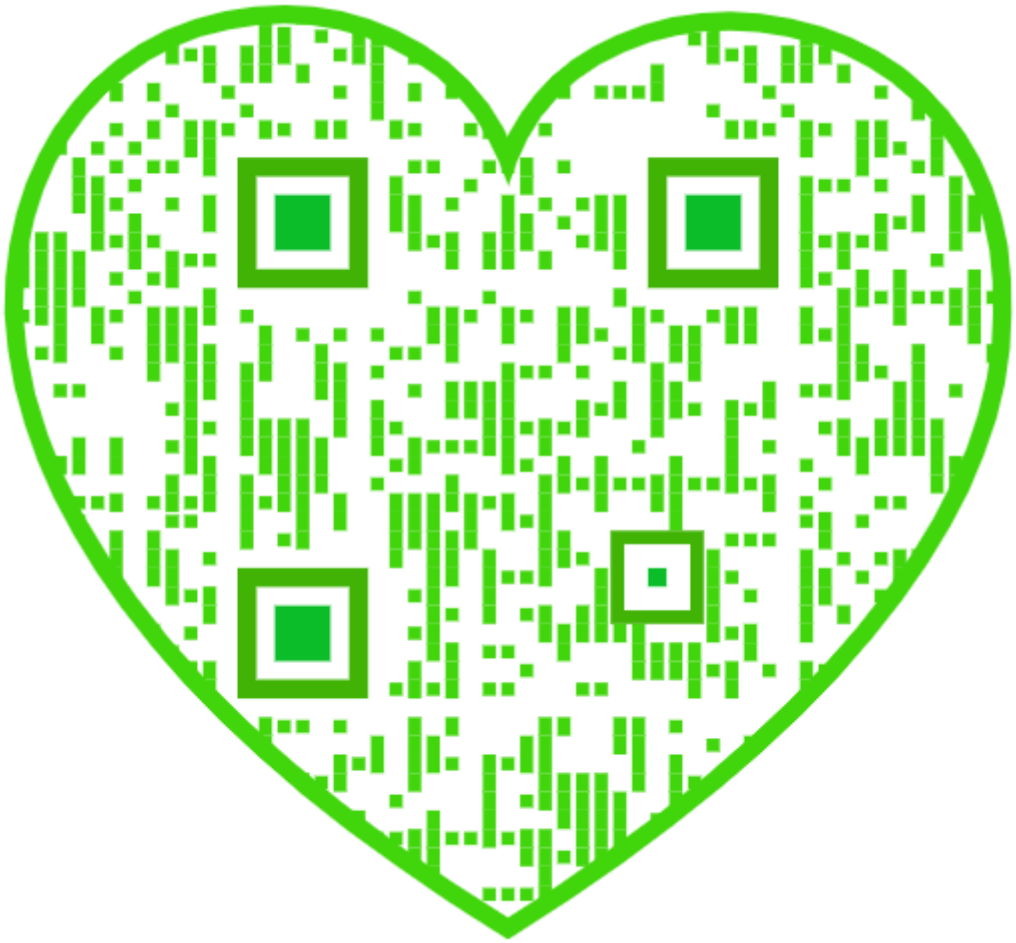

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PROFITS OF THE PARIS EXPOSITION.

M. A. Neymarck has recently made an interesting communication to the *Chambre Syndicale des Industries Diverses* of France, on the subject of the profits of the late exposition to France in general. These he considered from the most varied standpoints. A *resume* of his work is of special interest now.

The gold reserve or balance in the Bank of France was enormously increased. On October 25, 1888, it was 1,021,641,845 francs. A year later, as the exposition was on the point of closing, it had increased by 272,640,240 francs. It was calculated that Americans brought over and spent 350 millions of francs in gold. During the exposition one and a half million of foreigners visited France; the greater part were distributed thus: Belgians, 225,400; English, 380,000; Germans, 160,000; Swiss, 52,000; Spaniards, 56,000; Italians, 38,000; Russians, 7,000; Swedes and Norwegians, 2,500; Greeks, Roumanians, and Turks, 5,000; Africa (principally Algerians), 12,000; North Americans, 90,000; South Americans, 25,000; Oceanica, Java, etc., 3,000.

The gold reserve of the Bank of France was not the only gainer; the other banks of Paris showed an increase of 86 millions of francs. The receipts of the railroad companies were 66 millions of francs larger than for the corresponding period of the preceding year. The omnibus company running stages through the streets of Paris reports an increase of receipts over the same period of 1888 of four millions of francs. The cab company transported 29,097,112 people from January 1 to November 1, 1889, instead of 12 millions in the same period of 1888. This brought an increase of revenue of 1,558,000 francs. Four free stages run by the Louvre stores carried 1,320,000 passengers *gratis*. Spring vans were utilized, and as an example of their profits, it is said that the conductor of one of these vehicles acknowledged he had made 33 trips on the day of the closing, carrying eight people at one franc apiece each trip; giving as receipts for one day 264 francs or about fifty dollars. There were about 300 of these vehicles in use.

The tramways from May 6 to October 31 carried 6,342,670 people, giving over a million and a half francs receipts. Sometimes they transported 10,000 people per hour from the Place de la Concorde to the Machinery Hall. The cars running around the city carried 30,000 people a day more than in 1888.

The *octroi* or internal revenue of the city of Paris felt the effects of this increase of visitors. For the first ten months of 1889 it showed an increase of 10,398,721 francs over the estimates, and an excess of 9,946,551 referred to the same period of 1888. The excess of wine drank in 1889 over that drank in 1888 was 3,162,227 gallons; the excess of meat eaten was 3,278,871 lb. The total consumption of wine was 31,586,189 gallons; of meat, 94,680,630 lb.

The theaters showed an excess over 1888 of 10,867,555 francs receipts after payment of the *droit des pauvres* (poor tax) of 2,045,398 francs in place of 958,643 francs in 1888.

The restaurants on the Champ de Mars (*bouillons Duval*) received six millions of francs, 1,640,000 more than in 1888. A single restaurant toward the close of the exposition served 20,089 meals varying from less than a franc in cost (of which latter 267 were served) upward, only 95 exceeding five francs. The greatest number cost between 2 and 3 francs each.

The Eiffel tower, costing 7,514,095 francs, had a gross income from May 15 to November 5 of 6,459,584 francs.

The exposition proper showed a profit of eight millions of francs against a profit of 4,130,840 francs at the exposition of 1867, and a loss in 1878 of 31,704,890 francs.

Adding together the increase of the bank balance, of the receipts of railroads, of the revenue, etc., a total gain not far short of five hundred millions of francs will appear To this must be added the strictly private receipts. Allowing one million and a half of foreign visitors spending an average of 500 francs each, and six millions from the provinces of France spending an average of about 100 francs each, 1250 millions appear as the private receipts, giving a total of 1750 millions of francs direct monetary gain, or about 350 millions of dollars.

AMERICA'S TESTIMONIAL TO FRANCE.

The National Society of the Sons of the American Revolution has inaugurated a movement intended to give expression in the form of some suitable testimonial of the deep sense of gratitude which the people of the United States cherish toward the people of France for the magnanimous aid, naval, military, and financial, rendered by the French to this country at the critical moment of our revolutionary war.

From the beginning of the struggle the active sympathy of the French was extended to our countrymen, which found expression in supplies of money, of arms, and of men. In 1778 treaties of amity, alliance, and commerce with us were signed in Paris. In the summer of the same year a large French fleet was sent to our assistance, and from that time until the close of the war and the signing of the final treaty of peace at Paris, September 3, 1783, the French continued to be our faithful allies, assisting us in every possible way, supplying us with arms, munitions, soldiers, and ships of war. Among the practical fruits of this timely and most generous assistance was the capture of Lord Cornwallis with 106 guns and 800 men, the veterans of the British army, at Yorktown, October 19, 1781. On this glorious occasion the French were on hand with a fleet of 37 war vessels and 7,000 men, the American forces under Washington numbering 9,000 men. This practically ended the war, and peace soon followed. The blessings which have ever since ensued to us may be attributed in a high degree to the aid thus given us. We may never hope to repay these benefits, for they are priceless; the most we can do is to ask the acceptance of some souvenir indicative of the obligations which as Americans we owe to the people of France.

In money alone the French expenditures on our behalf are estimated to have been between ten and twenty millions of dollars; say fifteen millions—a sum which if put at interest would probably by this time have amounted to over three thousand millions of dollars.

Coming now to the practical business of the proposed testimonial—the matter is in the hands of a committee of eminent gentlemen resident in different parts of the country, as follows:

Chairman, William Seward Webb, cor. 44th and Vanderbilt Streets, New York City.

Hon. Chauncey M. Depew, New York City.

General W. S. Stryker, Trenton, N. J.

General W. H. F. Lee, Burke's Station, Va.

Governor S. B. Buckner, Frankfort, Ky.

Mr. Goldsmith Bernard West, Jacksonville, Ala.

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Mr. E. S. Barrett, Concord, Mass.

Rev. Charles Pinckney, Charleston, S. C.

W. H. Brearley, Detroit *Journal*, Detroit, Mich.

Treasurer, Mr. James Otis, No. 22 East 10th Street, New York City.

The committee has suggested that individual subscriptions to the amount of $1 each be solicited by those who take interest in the matter, to be forwarded, with the names of the subscribers, to the treasurer, as above. A large amount has already been received.

We hope every reader of the SCIENTIFIC AMERICAN will do his share in promoting this most noble and patriotic enterprise. Let each one open a subscription list in his own family and extend it, as time permits, among his neighbors. Any further information may be had from members of the committee.

We believe no definite decision has been reached as to the exact nature of the proposed testimonial. For ourselves, we wish it could take shape in something grand and useful, worthily representative and permanently commemorative of the gratitude of a great people toward the greatest of benefactors.

We propose the erection in France, wherever the people of that country shall designate, of a building which in exterior form and dimensions shall be a copy of the Capitol at Washington, with its stately dome and statue of Liberty; the building to be constructed of materials and filled with objects from this country, exemplifying within and without, in the most interesting manner, the richness and variety of our resources; the walls to be adorned with sculptures and paintings by the ablest masters, commemorating the heroes and achievements of the French, both in the early history and settlement of this continent as well as in the later period when they came to our aid in the war. In brief, we would build, endow, and present to the French people a museum of America, great, complete, and substantial, a worthy and perpetual token of the sincere regard and grateful veneration with which the people of France are held in the hearts of the American people.

The idea of an American testimonial to France appears to have originated with Mr. W. H. Brearley, of the Detroit *Journal*, and he made the appointment of the chairman, Dr. Webb.

Electric Welding of Shells.

Modern Light and Heat says there is another electrical industry about to be established at West Lynn, Mass., for the manufacture of welded shells. The Thomson Electric Welding Company is pressed beyond its capacity in the demand for welding machines, which will be used extensively in the new enterprise. The government has already given an order for 100,000 shells for the Hotchkiss gun and Shrapnel shells as soon as facilities for their manufacture, under the patent of Lieutenant Wood, U. S. N., are ready. By the new process the shells, instead of being made of cast iron and boxed as formerly, are made by welding the chilled point and butt to a section of soft iron pipe, and, in the case of Shrapnel shells, the trouble of graduating the thickness with calipers, after boring and adjusting the delicately poised diaphragm between the powder and the bullets, is greatly diminished.

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Recent and Needed Improvements.

The steam hammer has given such perfect results in the cushioning effects of steam that a substitute in the form of compressed air must be employed where other motive power than steam is used.

There is quite a tendency among inventors and mechanics to bring into use the driving effects of hydraulic power whenever a steam plant is to be called upon to operate the machinery, and the mill privilege, with its never-failing steam, must be utilized in compressing air, that the machinery may have some of the expansive benefits that are to be found in the steam engine.

The exhaust from a steam boiler should step right back into the boiler as readily as if the engine was simply an exhaust injector, and the units of heat that pass up the smoke stack should be dispensed with at once by firing up the plant on the principle of the soda engine. It would seem quite easy to construct a boiler with the fire box in the same compartment with the steam room, and the fuel as well as the draught supply pumped in with the feed water, and allow the engines to make use of all the gases, as well as the mechanical unison of heat and water known as steam. If fears are entertained for the air pump when the condenser is in use, a highly hydrogenous fuel should be used, which will leave the greater part of its own product of combustion the same as that obtained by evaporating the feed water.

Where a battery of boilers are kept under fire, the engine must keep a set of pumps at work, that the freight as well as the passenger elevator may be driven by hydraulic power. Speaking of boilers, how an inventor must shake his head when he examines the amount of waste found in a modern steam plant, and what a wonderful chance there is for an improvement! Will some inventor take notice?

We shall expect before long to find in the list of patent improvements a substance or a compound ground up and sold in the form of corn cakes that will disintegrate spontaneously, similar to sky rocket powder, which will only need to be thrown into a soda tank to supply an engine with driving power for ten hours.

A novelty in the manufacture of steam pipes consists in the fact that a core of some kind has been invented which may be thrust through a mass of melted steel after it has been poured into the mould. The utility of such a device goes without saying.

A machine has been devised that separates quartz sand into different grades from 4 to 60 by simply allowing the sand to drop or rain down on to a revolving cylinder. Every grain receives the same velocity when it leaves the cylinder, and the simple resistance of the air effects the separation—so it is claimed.—*Mining and Scientific Press.*

Cost and Productiveness of Labor.

The U. S. Commissioner of Labor is preparing to transmit to Congress his first report on the cost of production. The commissioner has been engaged on the report for several months and has obtained some very interesting and valuable material. The purpose is to ascertain all the elements that enter into the cost of production of a manufactured article, and Congress extended the inquiry to foreign countries, in order to obtain facts bearing upon the tariff question. The commissioner's report will embody data that have never been presented in any official report in any country. It will undertake to give with precision not only the elements of cost in the production of an article, but the efficiency of labor in different countries and in different lines of industry and the relations between efficiency, wages, and manner of living. The labor will be reduced to the hour basis, and it will be possible to determine, by an examination of the tables, the precise relation between the wages in the United States and European countries and the relation between the work performed in each country for those wages. The cost of management, the cost of repairs, the interest on invested capital, will all be set forth with a fullness which will admit of the most searching comparisons. Where a product is composed of more than one material, each of the raw materials will be followed to its source, and the cost of producing it set forth. The report on iron and steel will be sent to Congress within a few weeks, and those on cotton and wool will follow soon after. The other reports upon which the commissioner is at work are on glass, linen, silk, and lumber. These facts will be of use from a theoretical standpoint and in tariff and industrial discussions. They are so full and precise that they are likely to have a still further use for the practical business man. By comparing the statements for different establishments he can learn what others in his line of business are spending for the different elements that enter into their products, and can correct his own methods by the study of those of others. The hours of labor, the wages paid, the cost of raw material, the cost of subsidiary materials, the cost of management, will all be set forth and can be studied by the intelligent business man.—*American Analyst.*

Party Walls.

A case which recently came up in Washington, according to the *American Architect and Building News*, suggests a question in regard to party walls which is of very great importance as a matter of construction, although it has, so far as we know, never been mentioned in a court. It seems that the regulation in regard to party walls in the District of Columbia was composed, or perhaps copied, from some regulations existing in Philadelphia by no less a person than President Washington, and his rule has been the law ever since. Under this, if a person puts part of the foundation of his wall on his neighbor's land, that neighbor is entitled to use the wall above ground as a party wall, even though the wall above the foundation may be wholly on the land of the one first building. To architects, this view of the matter will seem very reasonable, and it would certainly be of advantage to the art of construction to go still farther, and to say that, at least in certain localities, every wall built within two feet of the boundary line between two adjacent properties should be built with its center on the boundary line and made a party wall. The reason for this is, of course, that no wall is properly built, the center of which does not stand over the center of its foundation; and that, where two independent walls are built on adjoining properties, close to the boundary line, both of them must, under the most favorable conditions, stand on the extreme edge of their foundations, at the imminent risk of causing the footings to tilt, or "roll," producing settlements and cracks, and bringing about ultimately the destruction of the wall.

In practice, however, the first comer always gets his footing stone a little over his neighbor's line, and, when the latter builds, he is obliged to have either the first footings cut off, endangering the old wall, or to set his own footings back, and build his wall overhanging them, at the great peril of his own construction. The matter is particularly serious with pile foundations. In this case the first to build always drives a row of piles tangent to the boundary line, and his wall above ground rests vertically over this row of piles, the second and third row of piles, driven parallel with the first, helping to carry the load, but in an indefinite degree, depending on the bonding of the footings and other circumstances. When the second proprietor comes to build, however, and finds the first piles driven close to the line, he is prevented from following a similar course on his own side. Not only does the form of the pile-driving machine render it impossible to get it near enough to the existing wall to drive piles vertically within six or eight inches of the line, but it is difficult and dangerous to drive even so near as this, and, in practice, the nearest row of new piles is often driven a foot or more back from the boundary line. When the remaining rows are driven, the footing courses laid, and the superstructure begun, the new wall, if it is built close to the line, as it usually is, stands over nothing, the nearest row of piles of the three which are supposed to support it being some distance back from the line of the wall. It is marvelous that walls constructed in this way, of which there are hundreds, stand at all, and they would probably not do so, except the support which the second wall gets from leaning against the first; yet the only alternative is to drive the piles for the second wall obliquely so as to crowd them in among those intended for the first wall. This method, although often followed, is, in most cases, even worse than the other, as it brings the new wall on an inclined support.

The best course in all such cases, and the one which should be required by law, is to arrange the piles and the footings as if for a party wall, building the wall above ground on the party line or not, as circumstances may require. The last comer, in case he wishes to erect a heavy building on his side of the line, can drive additional piles, and, by the arrangement of the footings, utilize them, as well as those already there, to support his wall, which will thus rest nearly on the middle of the foundation, and be under conditions favorable for stability.

Securing Immediate Suction in Dentures.

Some years ago, somewhere in dental literature, I came across a suggestion for securing immediate suction in a new dental plate or a newly repaired one. It has been of so much use to me that I herewith submit it, and advise its trial. The plate is moistened, and then simply sprinkled with fine powder of gum tragacanth. The plate is then pressed in place, and no matter how good or bad a fit, it will hold firmly for a day under almost any use or abuse. The advantage of this will be apparent to any one; for the first half hour or few minutes after a plate is put in for the first time makes or mars the reputation of the dentist, for the time being, in the estimation of the inexperienced patient, whose efforts to "suck up" a plate, if not immediately successful, are at once discontinued, the plate is taken out, and the invariable remark is, "It don't fit."

A patient will bring a rickety, ill-fitting plate, and after being without it the few hours necessary to repair it, will insist that the plate fitted perfectly before it was confidingly submitted to our care, but now it feels as though it had been made for another party. A thin coating of tragacanth will even up all irregularities, soothe the wounded sensibilities of the patient, and prevent the plate wounding the sensitive membrane of the mouth.

Tragacanth is a white gum like arabic, but has special advantages for this use, as it swells when wet by the fluids of the mouth, becomes sticky and of the consistency of jelly, but does not dissolve or wash out for hours. It should be kept in a salt or flour shaker with fine perforations in the top, and should be sprinkled on the surface of the plate, shaking off all the free powder after a moment. Having no odor and little taste, it is in no way objectionable. It might be put up in suitable perforated boxes and flavored with wintergreen, or otherwise made more elegant, mysterious, and costly. If the dentist is of the opinion that time and use will improve the general adaptation of the plate, a small box of tragacanth should be presented to the patient with directions for use when there is a varying atmospheric pressure which may possibly affect the suction of the plate! Its use will also obviate the necessity for labored explanations as to the cause of certain plates only resting on certain prominences of the maxillary and certain other tender places on the mucous membrane. It will also be a relief to the patient, for the mental effort necessary to the intellectual digestion of these scientific dissertations, and to retain a credulous expression of countenance, is often evidently as painful as the sharp edges of the plate.—*L. C. Bryan, Dental Cosmos.*

Electricity as a Manufactured Article.

At Harrisburg, Pa., Judge Simonton handed down two opinions recently in the Commonwealth of Pennsylvania cases against the Philadelphia Electric Lighting Company and the Brush Electric Light Company, of the same city. Both of these companies claim to be manufacturing concerns, and, as such, exempt from taxation under the recent act taking the tax off from manufacturing companies. The opinions discuss at great length the means by which electricity and electric light are produced, and quote extensively from the testimony of Professor Henry Morton, President of the Stevens Institute of Technology, whose testimony as an electrical expert was taken in these cases.

But Judge Simonton adheres to his opinion, reached in a similar case about a year ago, that producing electric light is not a species of manufacture. He held that neither electricity nor electric light was a material substance; that there could be no manufacture unless some material substance was produced. It is expected that these cases will be argued in the Supreme Court on appeal at its meeting in June. In these cases a great deal of evidence was taken to show the unequal operation of the present tax laws upon different corporations. The lack of uniformity, it was claimed, made the tax unconstitutional. Judge Simonton, however, sustains the constitutionality of the tax, except as to the amount involved on patent rights granted by the United States, which he holds are not subject to taxation. Upon this point the Attorney-General may possibly appeal. The full amount of the Commonwealth's claim against the Philadelphia Electric Lighting Company is allowed, with interests and cost; but in the case of the Brush Company the amount is largely reduced by the decision as to the invalidity of the tax on patent rights.—*The Electrical Engineer.*

The Nadria Aqueduct.

The great Nadria Aqueduct in India carries a canal 150 feet wide or thereabout across fifteen arches of 60 feet span. In an account by the correspondent of *Engineering*, it is stated that the foundations, which are on circular wells, all go down some 55 feet below the bed of the river which the aqueduct crosses. The fifteen arches are divided by abutment piers into groups of five spans each, the abutment piers have each two rows of wells, and the single piers one row. Thanks to the simple expedient of building the work in a pit dug out of dry land through which the river was subsequently diverted, the work of sinking the 268 wells went on without interruption throughout the year. It is probable that no other well-sinking job has been so systematically worked out—and, indeed, in the beds of active rivers there is no such chance of careful administration; for as the river rises and falls, the conditions to be dealt with change completely. The aqueduct carries the Lower Ganges Canal across what is known locally as a nuddee, *i. e.*, a watercourse that draws its water supply from the plains of Hindostan, and not like what are here known as the rivers proper from the mountains. The canal that goes over the top draws, in ordinary years, a revenue from the land it waters of some £50,000 sterling a year, and a work that secures that revenue at a cost of £300,000 sterling has much need to be pushed on with the utmost expedition. Fortunately, owing to favorable rainfall during the four years that the aqueduct was under reconstruction, the loss of revenue actually experienced was but a tenth of the total. Had the case been the other way, the loss of food crops in even one year would have far overtopped the price of the work.

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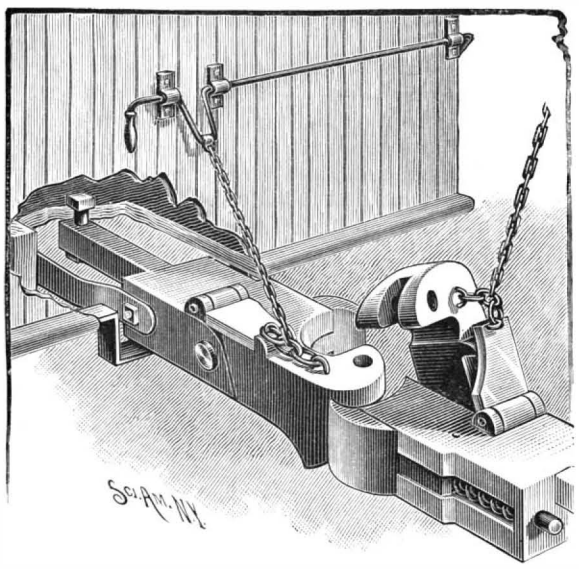
AN IMPROVED CAR COUPLING.

The illustration shows a device adapted for use with passenger as well as freight cars, and which can also be applied in connection with the ordinary link and pin coupling, the hook being locked in place to prevent its displacement when the cars are coupled and prevent their accidental uncoupling. The invention has been patented by Mr. Simon J. Freeman, of Bradford, Pa. The drawbar is pivoted to the under side of the car, a spring holding it in normal longitudinal position, but allowing some sidewise movement. The hook pivoted on the front end of the drawbar is always held in horizontal position unless swung upward by the operator by the means shown, and is adapted to engage a corresponding hook part on the coupler of the opposite car. In the hook end of the hook is a slot adapted to receive

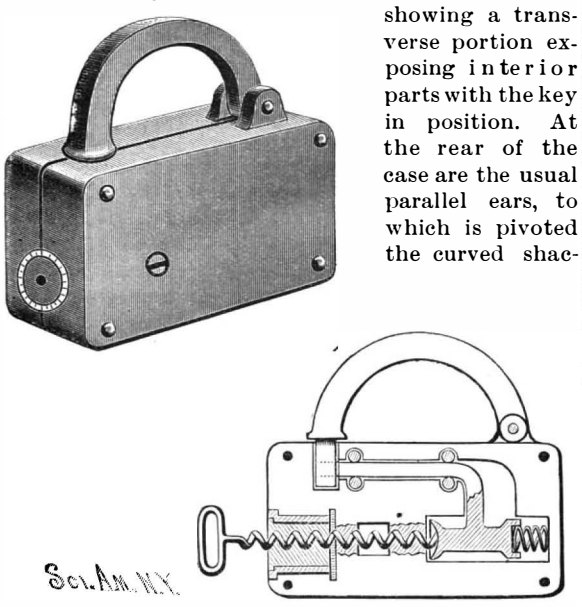


FREEMAN'S CAR COUPLING.

the ordinary coupling link, to be engaged by a vertically sliding pin. On top of the drawbar is pivoted a locking plate, extending over the pivoted end of the hook and abutting against a lug thereon, thus preventing the hook from accidentally swinging upward. An eye on the free end of the locking plate is connected by a short chain with the chain for raising the coupling hook, whereby the locking plate is raised out of contact with the lug as the hook is swung upward. To one side of the coupling hook is arranged a sliding hook having on its rear end a longitudinally extending shaft, around which is a coiled spring, the projecting ends of the sliding hooks yielding as the cars come together in coupling, and then being pressed forward by their springs to surround the ends of the coupler hooks, and hold them in place against accidental disengagement.

AN IMPROVED PADLOCK.

The illustration represents an inexpensive and novel form of lock and key which has been patented by Mr. Woodson Mosley, of Toledo, Ark., the sectional view showing a transverse portion exposing interior parts with the key in position. At the rear of the case are the usual parallel ears, to which is pivoted the curved shac-



MOSLEY'S PADLOCK.

kle bolt entering a socket orifice at the front of the case, the shackle end being transversely perforated to align with a longitudinal channel in each half section of the case. The rear of this channel is curved downwardly and widened to provide for the movement of the downwardly curved inner end of the bolt, and is connected with a recess in which slides the bolt head, the rear end of which is cupped to receive a spiral spring holding the bolt in locked adjustment. The key consists of a spirally formed wire rod adapted for insertion in a corresponding passage in the lock body, and designed to abut against a cupped end of the bolt head, forcing it back and releasing the shackle. Between the front end of the lock case and the bolt head is a rectangular cavity dividing the spiral passage into two divisions, to prevent the use of an ordinary piece of wire for a key, as such piece of wire adapted to take the form of the spiral would be likely to abut against the rear wall of the cavity, and thus be prevented from entering the rear section of the key passage, the key itself being made of correct pitch and unyielding material. In a circular recess in the front face of the lock is an adjustable sleeve, in which is a rotatable solid cylinder with a spiral key passage, there being on the outer end of the cylinder graduations, a slight deviation from a correct adjustment of the cylinder and sleeve preventing the complete introduction of the key. The sleeve and cylinder are also adapted for adjustment revolubly and longitudinally, the graduations on the exposed ends furnishing means therefor to cause the spiral passage in the cylinder to assume a proper relative position with regard to the similar key passage in the body of the lock for the introduction of the key.

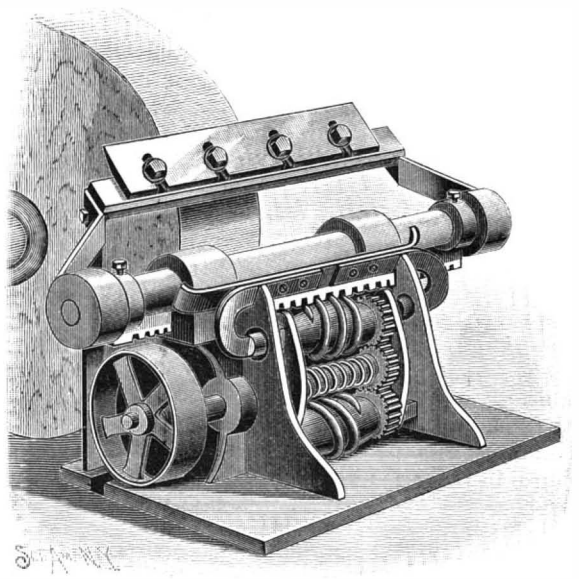
TESTING CAST IRON.—In the case of those foundries which obtain their pig directly from blast furnaces the testing of cast iron is especially important, as charcoal blast furnaces are very sensitive to any accidental change in the mixture. The metal, which is taken from the furnace by means of a ladle, the matter floating on the surface being removed, is poured into an open sand mould in the form of a cavity of about twenty centimeters in diameter and seven or eight centimeters in depth. Iron which is rich in silicium and carbon becomes rapidly coated on the surface with a dull glowing cover of oxide formations. These dull formations also indicate an iron too rich in graphite. Bright and long lasting formations distinguish the iron best adapted for casting purposes. If the iron in a little time becomes rapidly blistered, or if it throws off hissing sparks, it is a proof that it is poor in silicium and hard. A practiced eye will readily perceive the peculiarities in the nature of the iron by carefully observing the formations.

AN IMPROVED BLANKET HARNESS.

The illustration represents an improvement in blanket stays, whereby stable blankets especially may be securely held in place, and the blanket worn with comfort. The invention has been patented by Mr. John Grim, of No. 323 Diamond Street, Philadelphia, Pa. A saddle is employed consisting of a single piece of soft leather curved to fit the back of the animal near the crupper, and to the upper face of the saddle are attached parallel billets, one of which is made to form a loop adapted to be engaged by a tie strap secured to the inner face of the blanket. The billet ends of two back straps are also secured to the forward end of the blanket and made to lap over its outside. At each side of the saddle are hip straps of a loop form, each having a sliding cross strap limited in its downward movement by stops, the cross straps serving to regulate the width of the loops and contacting with the outer upper portion of the animals hips when the blanket is in position. Upon the inner face of the bow portion of each hip strap, or that part adapted to lie in the crotch, is a pad to prevent chafing, and there are connecting straps secured to each hip strap at this portion, forming a compensating attachment, whereby the animal will not be in the least incommoded by the harness when walking, the hip straps automatically adjusting themselves to every movement. This harness may be quickly and conveniently attached to or detached from any blanket.

AN IMPROVED KNIFE GRINDING MACHINE.

The accompanying illustration represents an automatically acting machine designed to rapidly and accurately grind straight-edge knives to a bevel edge. It has been patented by Mr. William D. Graves, Jr., of Presque Isle, Me. A cylindrical shaft is held to rock and slide in suitable housings in front of the grindstone, and below the shaft are grooves in the boxes for loosely supporting a rack held in place longitudinally by the hub ends of a knife-supporting frame. A skeleton knife-supporting frame is attached to the shaft, near its ends, by set screws, and the boxes in the upright housings have their horizontal bores in alignment for the revoluble support of the driving shaft, upon which are mounted two transverse rock arms, perforated to fit and rock upon the shaft, the rock arms carrying short journal shafts, on which are worm sleeves and pinions, the worm threads on the sleeves being pitched in opposite directions, and arranged with such relation to the teeth on the rack bar that the worms may be successively caused to engage the rack teeth by a half revolution of the rock arms on their support. In the upper part of each flange piece or lateral brace on the upright housings are open guide slots to receive a composite tappet bar and loosely support it to move endwise, this bar having on its side shifting dogs, which, in connection with movable abutment collars mounted on the body of the sliding rack bar, outside of the supporting boxes, are designed to limit the longitudinal movement of the rack bar. The abutment collars are so adjusted to the length of the knife to be ground that the latter will be made to traverse the stone or emery wheel from one end to the other of the knife and grind it to a true bevel edge. These collars are adjustable in such manner that the reciprocal travel of the knife-

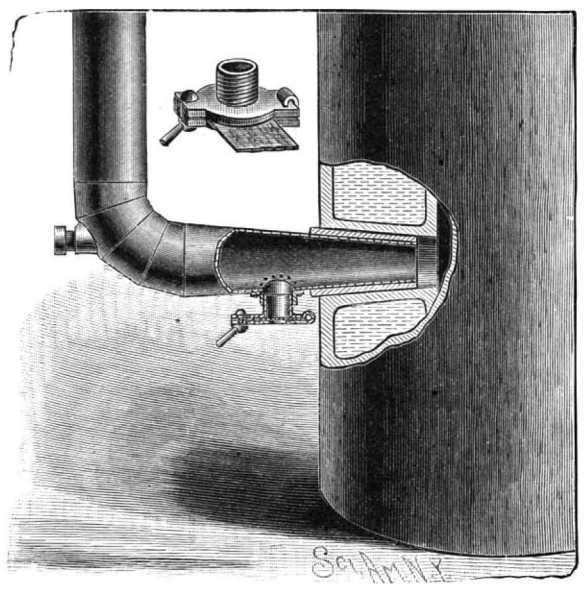


GRAVES' KNIFE GRINDING MACHINE.

carrying frame may be shortened to suit knives which do not require the full longitudinal movement of the machine.

A SLAG ESCAPE FOR TUYERES.

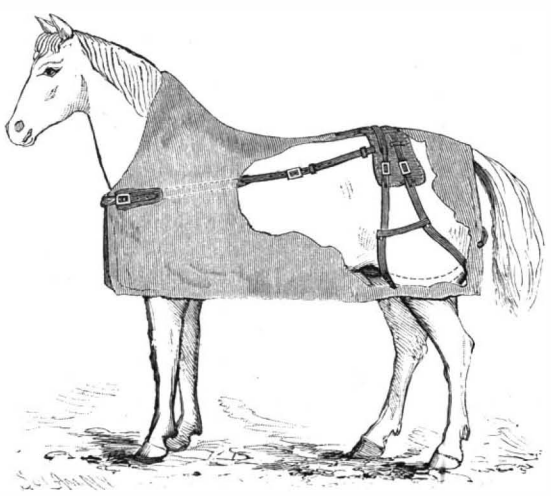
A simple form of slag escape and alarm, for use in smelting furnaces, to keep the blast pipe and tuyere open and give an alarm when the slag rises above a normal level in the furnace, is shown in the accompanying illustration, and has been patented by Messrs. John C. Bansemer and Edwin L. Davies. In the reduced end of the blast pipe, where it passes into the furnace through the usual water jacket, is formed an opening leading to a downwardly extending pipe or nipple, on which is secured a flange. On this flange is hinged a



BANSEMER & DAVIES' SLAG ESCAPE FOR TUYERES.

centrally apertured plate, and between the flange and plate is placed a destructible cover, of muslin, canvas, paper, thin sheet metal, or other suitable material, such covering resisting the force of the blast and normally closing the aperture. When the slag rises in the furnace sufficiently to flow into the end of the blast pipe, and drop into the opening, the temporary cover of the aperture therein is quickly burned or melted away, so that the slag flows out without settling in the pipe and clogging it up, while the blast, following the slag, rushes through the opening, making noise enough to give an alarm.

For further information relative to this invention address Mr. Charles E. Beers, No. 262 South Second West Street, Salt Lake City, Utah.



GRIM'S BLANKET HARNESS.

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A LESSON IN REPOUSSE.

This art, as practiced by the silversmith and artist, is almost entirely dependent upon the manual dexterity of the operator. A kind of repousse is here suggested which depends more upon appliances than skill.

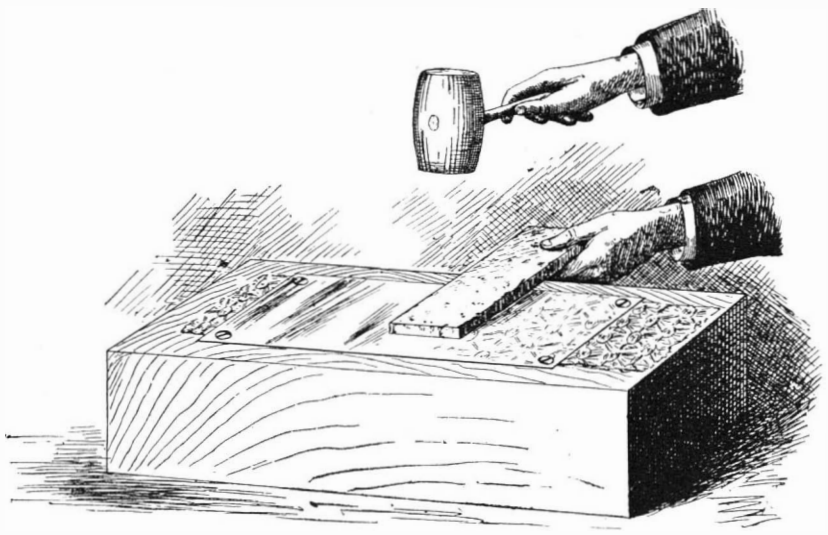

Fig. 1.—EMBOSSING THIN METAL.

It is not, however, assumed that any set of devices can be made to serve in lieu of taste and judgment.

To carry out this method, a piece of heavy cotton lace, or heavy openwork fabric, or a piece of a basket may be glued to a block of hard wood to serve as a sort of die for producing the impression in the metal. The fabric or basket work is not only attached to the block by means of glue, but its finer interstices are filled with glue, so as to present a surface resembling the original fabric only in the most general way. When the glue is perfectly dry and hard, the die is laid upon a solid foundation, and a piece of very thin soft copper or brass is secured to the block so as to cover the lace, as

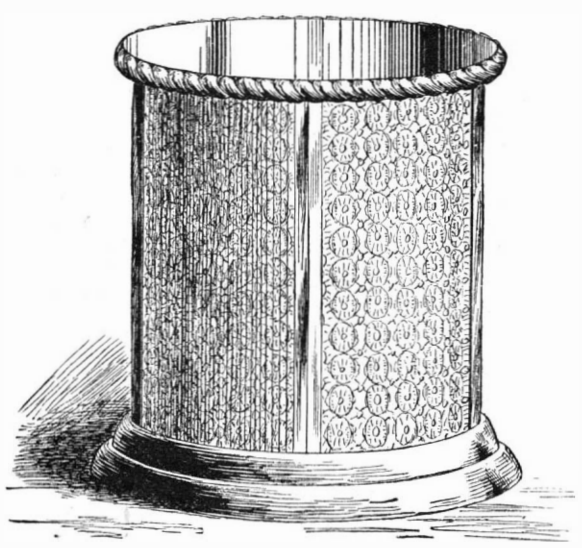

Fig. 4.—VASE FORMED OF EMBOSSED PLATES.

shown in Fig. 1. A piece of cork about one-quarter inch thick and about three inches wide and six or eight inches long is laid over the metal, and struck with a mallet, as shown. The cork yields sufficiently to push the metal down upon the die, and cause it to take the pattern of the lace or whatever is used in forming the die. A piece of rather hard rubber packing will answer this purpose equally as well as the cork.

Designs may be cut from strong paper or pasteboard and glued to the block, or a stencil design may be sawed from hard wood. The lines and scrolls are discontinued in places, so as to cause the wood to hold together. If it is desired to render the lines continuous

Fig. 5.—A BASS-RELIEF IN LEAD, COPPER, OR BRASS.

at these points, they may be run through with a V-tool. Dots are picked out with a small gouge or the point of a revolving drill. In all these cases the metal is attached to the block and treated as shown in Fig. 1.

In Fig. 3 is represented in side elevation and in section a die formed of a small rope glued in a semicircular groove in a bar of hard wood. The embossing is done in the manner before described. In this case a thick piece of soft rubber is preferable to cork for forcing the metal into the depression of the die.

Either panels or continuous strips may be embossed in the manner described, and these are to be used in making frames, vases, and various ornamental objects. If the metal is too thin for a certain case, it may be strengthened by flowing soft solder over the back of the plate by means of a soldering iron.

The vase shown in Fig. 4 is formed of four embossed plates of copper, fastened to the back of four vertical brass strips by solder, the whole being secured to the bottom piece in the same manner. The bottom consists of a disk of copper soldered in. The base is formed of a brass stovepipe collar soldered to the lower part of the body of the vase. The rim around the top consists of a strip embossed on the rope die.

As to finish, any of the several well known methods of oxidizing or lacquering may be employed. This vase is especially adapted for containing a palm or other large foliage plant. The earth and roots may be placed directly in the vase, or they may be contained by a pot which is inclosed by the vase.

It is obvious that vases of other forms and other embossed designs may be made on this plan.

Bass-reliefs may easily be made by a method which is a modification of the one described. Fig. 5 shows such a relief, and Figs. 6 and 7 illustrate the tools required for making it.

To the wooden frame, A, is fitted a board, B, upon which is drawn in outline the design which is to be produced in relief. The board may be of pine or any close-grained, soft wood for lead work; but for brass or copper, the wood should be hard. To the frame, A, is attached the plate of metal by means of screws.

The board, B, is removed from the frame, and the portion of the design which is to form the most prominent feature of the relief is sawed out of the board, when the latter is replaced in the frame, and the metal is forced into the opening of the board by pressing upon the surface of the lead opposite the hole in the board, or by pounding it by means of the mallet, C, shown in Fig. 7. As soon as this feature is complete, the next in order is sawed out of the board, and the operation is repeated until all of the general features are developed. The progress of the work can be observed at any time by removing the board, B.

The features may be corrected or modified by working from either side of the plate by means of the convex mallet and the wooden punches and chisels, D (Fig. 7). If a support is desired for any part while the work is progressing, a stout bag filled with sand may be placed under the part. A few very small bags, say 1 inch or 1½ inches in diameter, will be found convenient. If desired, the drapery or the background may be chased by means of hard wood or metal punches, bearing on their faces the desired figures.

The relief, if of lead, looks well with an antique finish. This may be secured by rubbing the prominent portions of the relief with fine emery cloth, then going over the entire surface with a swab formed of a small roll of cotton cloth encircled by a coil of copper wire, the swab being dipped in dilute nitric acid before application to the relief.

The copper is dissolved and deposited upon the bright prominent portions, while a dark deposit is made in the hollows, which when dry has a green tinge.

To give the work the appearance of antique iron the surface may be blackened by the application of a solution of sulphuret of potassium and the prominent portions may be semi-polished by briskly rubbing the entire surface with a piece of canvas or Brussels carpet.

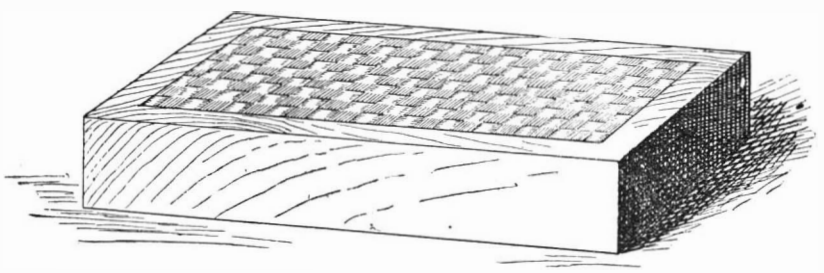

Fig. 2.—BASKET PATTERN.

Fig. 3.—ROPE PATTERN.

Detecting Leaks in Underground Gas Pipes.

A German paper thus describes a method of detecting leaks in underground gas pipes:

Test holes are sunk in the ground along the lines of the gas mains, and half inch wrought iron pipes about three feet long are inserted. In the upper ends of these pipes small glass tubes are placed, each tube containing a slip of paper moistened with chloride of palladium. The test papers turn black under the influence of illuminating gas, the rapidity and distinctness of the reaction depending upon the strength of the palladium solution and upon the volume of escaping gas. Under the most unfavorable conditions, however, an exposure of the test paper for a period of fifteen minutes is considered long enough to show whether or no gas is present. The test holes should be placed about six feet apart, and should not reach below the line of gas pipe. The main object is to penetrate the more or less compact surface material of the

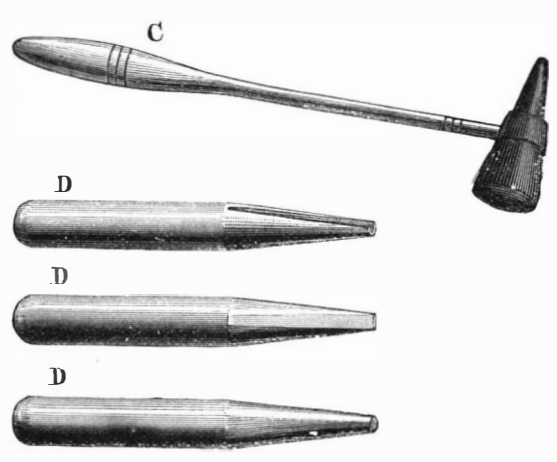

Fig. 7.—WOODEN TOOLS FOR REPOUSSE.

street, so that the gas in the ground has a direct and convenient means of escape. In many of the streets of Frankfort-on-the-Main, especially those having asphalt pavement, one inch pipes lead through the asphalt and the underlying layer of beton, their lower ends extending to within a short distance of the gas mains. These escape pipes are filled with pieces of sponge and are closed with cork stoppers. The pieces of sponge are renewed from time to time. The pipes have been found to overcome, to a considerable extent, the annoyance of digging up the streets for long stretches with the view of locating leaks in the main. —*Boston Transcript.*

Fig. 6.—FRAME AND FORM FOR MAKING BASS-RELIEF.

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Another Great Steamer.

The Normannia is the latest addition to the fleet of twin-screw steamers of the Hamburg-American Packet Company, and was built by the Fairfield Engineering and Shipbuilding Company (John Elder & Co.), at Govan, on the Clyde. She is 520 feet long, has a width of 60 feet and a depth of 40 feet, and is of 8,500 tons gross register or 10,000 tons displacement. In appearance she is similar to the other two fast boats of the Hamburg line, the Augusta Victoria and Columbia, having a straight stem and round stern, three huge smokestacks, and two polemasts.

Internally the ship is divided by eleven transverse bulkheads, which are carried to the upper deck, and the twelve separate compartments thus created do not communicate with each other, except on the main deck, which is far above the water line.

The machinery has 16,000 indicated horse power, there being two engines of 8,000 horse power each, which are separated by a longitudinal bulkhead. The engines are constructed on the triple-expansion plan, and have cylinders of 106, 67 and 40 inches diameter respectively, the piston stroke being 5½ feet. The boilers are also placed in separate compartments. The screws have a diameter of 18 feet and are of manganese bronze.

The promenade deck is 400 feet long and has 18 magnificent staterooms, and also the ladies' saloon, music room, and smoking room, fitted up in the most luxurious manner. The main saloon is on the upper deck. This is a magnificent apartment 72 feet long, decorated in sumptuous style, the most ornate and artistic effects being gained by a combination of rare wood carvings and beautiful panel pictures by well known artists.

The steamer accommodates 325 first class, 175 second class, and 175 steerage passengers. Most of the staterooms are on the main deck, a large number of them being furnished in splendid style. There are besides suites of rooms, with private bath and toilet rooms. The conveniences in the second cabin are also excellent and rival those of the first cabin on many other steamers. The steerage is unusually high, well lighted, and divided into small rooms. There is no doubt that the Normannia is one of the finest vessels ever floated.

She recently made the trip from Glasgow to the Elbe at the rate of 21 knots, or 24·15 miles, per hour.

Government Test of Woods.

In compound columns care should be exercised in selecting the sticks which are to form the column. Of course, it would be useless to place a poor with a strong stick, but it is best to place the good together and the inferior by themselves. To make the effects of knots in the resistance of short posts to compression more apparent, some columns, after having been tested and their resistance determined, were cut up and specimens of shorter length taken and tested; the difference in strength was very marked, as was to be expected. An oak column 168 inches long, which yielded at 4,953 pounds per square inch, showed in a specimen 52 inches long cut therefrom 8,450 pounds per square inch, and another 7,794 pounds per square inch, which then gave way at a knot. Another post 164 inches long failed at 3,432 pounds per square inch, but a piece 32 inches long was cut from it, which gave 6,230 pounds per square inch. A yellow pine post, 143 inches long, gave a resistance of 4,663 pounds per square inch, but a specimen 32 inches long was taken from it which had a resistance of 6,230 pounds per square inch. Pieces of smaller size could doubtless have been cut from each of these which would have shown still greater strength, as they might have been obtained more free from imperfections of all kinds. Knots of even small size, firm and sound, exercise an injurious effect upon timber. This was shown in a piece of spruce, from which two samples were cut, one having a uniform, straight grain, the other two small knots; the strength of the former was 11 per cent greater than the latter. "When we come to determine the resistance of specimens having knots to forces of compression at right angles to fibers of the wood, we find the resistance much increased, and this increase should be taken into account when selections for this purpose are possible. The resistance of specimens of a given wood, as compared with others of its kind, is generally indicated by its specific gravity, but this does not always hold good. In yellow pines, some of those rich in turpentine have a high specific gravity, and yet are not the strongest. The rapidity of growth will sometimes give indications of the strength. A rapid growth in oak is apt to be accompanied by an increase of strength, while the reverse is often true in yellow pine."—*Southern Lumberman.*

A Mechanics' Fair.

We are informed that the prospects for a successful exhibition of the Massachusetts Charitable Mechanic Association in Boston, which opens October 1, are very flattering. Space is being rapidly taken up by some of our finest manufacturing concerns and machinery builders. Those who desire to place their products before a New England audience will find this a very favorable opportunity.

The Kangaroo.

BY NICOLAS PIKE.

The great island continent of Australia, from its first discovery, has been known as the home and headquarters of marsupial animals; creatures not alone interesting from their peculiarities of form and habits, but for their high geological antiquity. They were among the earliest known mammals, coeval with the great iguanodon and other monsters, and were a prominent feature in America and Europe for ages. During the triassic, jurassic, and great reptilian periods they were numerous, from the giant *dipropon*, as big as an elephant, to the little *antechinus*, the smallest of known animals. Like so many other creatures whose race was run out, so the marsupial mammals became almost extinct, leaving only as types our own opossum and the varied species of kangaroos in Australia and New Zealand, principally the former.

The two largest species are called by the natives the "koorah" and "wallaby," and they are the only large wild animals known there. These are being driven back by constant hunting, till they are becoming scarce in the eastern districts. There are said to be over twenty species of pouched animals in that country, but it is of the above mentioned I propose to speak principally.

The habits of the kangaroos resemble those of the sheep and deer. They are very shy, and have the senses of hearing and smell very acute. They are gregarious, and are seen in droves of 20 to 50, but are then very difficult to approach. They are entirely terrestrial, and when alarmed rise on their hind feet and look about them. When they discover danger, they start off, leaping from fifteen to twenty feet at a jump. They are herbivorous, and during the warm, sultry hours of the day resort to cool, shady bush or forest, where they sleep, sallying forth in the evening for food.

In ordinary weather, the large kangaroos (*Macropius giganteus*) are seen feeding in the daytime, the drove led by an old buck. They eat principally grass, heather, and tender shrubs. The latter they browse on by standing erect on their hind feet. They are especially fond of what is called kangaroo grass, but will also eat barley, oats, or rye if they can get them.

Their ordinary position is a crouching one, on account of the disproportionate size and length of the hind and front legs. When they rise on the powerful hind toes, they often stand over five feet high, and they use their forepaws as handily as a squirrel does to convey food to the mouth. They can go a long time without water and are often found miles away from any rivulet.

A doe has but one young at a birth, although she has three teats concealed in her pouch. About thirty-nine days after conception, the embryo, while still of very small size and the limbs only in a rudimentary condition, is transferred from the uterus to the marsupial pouch, where it is attached by the mouth to one of the nipples, and there it remains till large enough to leave the portable nest in which its fœtal growth is accomplished. The feeble offspring continues to increase in size, from sustenance exclusively derived from the parent, for a period of eight months. After this time its small head may be seen protruding from the pouch and cropping the long grass at the same time as the mother. It lives thus till it is able to run alongside of her, but the instant she scents danger her little one is quickly thrust back into the pouch for safety. The natives call the young *joeys*, and they are pretty little creatures, with their soft silvery fur, sharp ears, and bright eyes.

The kangaroo can be easily tamed, and though a formidable animal to encounter in its wild state, when domesticated it is inoffensive and a very cleanly one. Since 1865 considerable attention has been given to its economic value as regards the use of its meat and skin. In 1874 an attempt was made to domesticate some in England, but being kept cooped up in pens like those of a menagerie, it totally failed. The problem of their acclimatization has however at length been solved, and experiments remarkably successful have been made.

At Tring Park, the residence of the late Baron de Rothschild, a number of kangaroos were brought from Australia and turned loose into the park and woods in hopes of breeding them. Unfortunately a male and young one were poisoned from eating the pernicious Portugal laurel. Fresh ones were imported, and the greatest success has crowned the efforts to breed and acclimatize in England. They have done so well that there are now in Tring Park twenty-eight or thirty native kangaroos, including the black and red species, Bennett's wallaby, the black wallaby and the large *Macropius* or giant kangaroo.

Now, as this curious and valuable animal has been so successfully bred in England, it is astonishing some enterprising American has not already introduced it into the United States. There is no doubt that with the same care that has naturalized the ostrich, kangaroo farming would be equally profitable. It would pay the government to place a few pairs in the Yellowstone Park, where they would be unmolested, and our large Western cattle farmers would do well to try them. It is surprising how little is generally known of the value of kangaroo skins as an article of commerce. Yet in Newark, N. J., 6,000 skins are said to be received every week from New Zealand and Australia for the making of fine shoes and other articles.

Up to 1869 the animals were only killed for their meat, and the skins cut up into shoestrings and leather thongs, etc. An Englishman about this time discovered the valuable quality of the leather and brought some skins to this country. The tanners fought shy of such hides, and he at last got rid of them to a bookbinder for corners for ledgers and commercial books. The valuable qualities soon after this began to be recognized, as the grain prevents its absorbing water, but then it was found very difficult to procure enough skins. Three years ago the establishment now working them in Newark sent out agents to make arrangements for a continuous supply.

It was very soon found that kangaroo hunting was a dangerous business, as when brought to bay it fights bravely for life and leaps like a flash on the hunter, trying to tear open the chest with the terrible claws of the front feet. Seven or eight men go out together, and wear a strong protection on the chest. Then the heat on the plains where the greater species congregate, whose skins are most valued, is often 140°. It is a profitable business all round, especially to the hunters if they escape accidents, as they realize about 70 cents a pound for the hides when sold at the seaports by auction for shipping to America. The trade is at present in the hands of the Newark tannery, who supply all the European markets with the leather, even sending the article back to Australia itself in another form.

Not only are the hides of such value, but its flesh also. The hind quarters of a large buck often weigh over eighty pounds each, and the hams find a ready sale. The tail and head are especial epicures' favorites. The flesh is dark and gamey, and though perhaps not equal to that of our deer, steaks from young animals are juicy and tender and much sought after. As we have every climate within our boundaries, it is quite certain we have all that is required for the kangaroo, and as they have not all the diseases sheep are heirs to, so much the more easy and profitable would be their rearing. As they have such decided grain-eating proclivities, we have another chance in our favor, as every cereal grows in abundance with us.

Since writing the above, I see in the SCIENTIFIC AMERICAN of April 26 there is a short notice of the scarcity of the kangaroo in Australia at the present day, and the rapid strides a great buffalo is making in the northern districts of the country.

The former animal has been as ruthlessly slaughtered there as the latter has been here. Formerly, kangaroos were killed in sport (so called), and in later years from their enormous consumption of grass. The latter fact, to an essentially sheep-producing country like Australia, where wool is their staple product, is of course a great source of trouble to sheep farmers.

The uncertain climate and frequent droughts render the preservation of extensive tracts of grass land of vital importance. Hence we can hardly blame those who kill the interlopers, that are each said to eat as much grass as six sheep.

Now we possess conditions decidedly favorable to the rearing of large herds of kangaroos. We have vast ranges of grass land in many States still, and likely to be only sparsely populated, where they can roam at will. They are easily tamed and become accustomed to their keepers, so they can be trained to return at night for grain food. Just here our illimitable grain crops will come in, and help to make kangaroo raising remunerative where there is a difficulty in realizing fair prices for cereals in the ordinary way, from freight expenses, etc.

How we wonder over the marvelous changes that have taken place in the dissemination and then extermination of so many races of animals! Yet here even in our own day there is a chance that the great bisons, so nearly extinct in America, where they roamed in countless herds, should be flourishing in far-off Australia. There is a likelihood that the descendants of the giant marsupials, once as common here as deer, but that fled from us as the ages rolled away, may become denizens of the very plains these far-off ancestors ranged over at will, but left no trace save a few fossil bones to be unearthed in our own times. Now the curious animals will be side by side with the horse, sheep, and cow, instead of the ferocious reptiles their co-mates in those myriads of years ago.

A NUMBER of capitalists of Seattle and Minneapolis contemplate the building of an immense flume or tunnel from Lake Washington to the shores of Seattle Harbor for the purpose of furnishing water power for manufacturing purposes. The level of Lake Washington is nearly twenty feet above that of the bay at high tide, and the plan, as proposed at present, gives eighteen feet of fall, which is sufficient for all purposes, as it is proposed to put in a tunnel large enough to carry water in sufficient quantities for the needs of the largest factories.

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Correspondence.

How to Break Bowlders.

To the Editor of the Scientific American:

In your issue of April 26 a correspondent asks how to break large bowlders.

Some ten years ago I superintended the sinking of a large well in which we got great quantities of very hard granite bowlders, varying from 100 lb. to 1,500 lb. in weight. The heaviest sledge we had brought to bear on them by a powerful man had little or no effect on them, but we broke them easily by means of giant powder without drilling holes into them.

We placed from one to eight sticks of ⅞ giant on a bowlder, according to the size, and put a shovelful of moist earth on the powder, just to keep it in position, fired the charge, and never failed to break our bowlder. If the pieces were too large to handle, and would not yield to the sledge, we repeated the operation until they were small enough. ALEX. BOWIE.

Monero, N. M., April 30, 1890.

Bricks from Coke.

The use of coke, coke dust, or graphite from gas retorts in the manufacture of refractory bricks for lining iron furnaces seems like a contradiction of nature; but it appears from several communications to a recent meeting of the Society of German Iron Manufacturers that an industry in the manufacture of such bricks for ironworks is actually established, and is growing. Hitherto nothing has been found capable of withstanding the corrosive action of blast furnace slag, which is alternately acid and basic, and carries away the lining of the hearths of the furnaces as though it possessed no resistance, although, as a matter of fact, everything is done to prevent this action.

The best refractory materials, if placed in the way of a current of slag, will completely melt away in an hour or two. The observation that slag runs best in a channel of coke or coal ash turned attention to this material for lining furnaces; and Mr. F. Burgess, of Gelsenkirchen, states that in his first experiments, in 1883, he tried a combination of coal, coke dust, graphite, and clay, moulded in the form of bricks. Unfortunately, in the process of burning these carbon bricks, the carbon largely burnt out; but even so, they gave satisfactory results. The process could not be patented because it is on record that furnaces in the Hartz Mountains have been lined with a similar combination of coke, dust, and clay.

It appears, also, from a paper by M. Purcel, that in a certain district of France the hearths and bottoms of furnaces have for some years been lined with graphite brick.

The raw material of these bricks was gas retort graphite ground and mixed with tar and then calcined. Part of the tar is coked, and binds the graphite into hard and durable bricks. Coke, poor in ash, treated in the same way, yields good results. These bricks give satisfaction in furnaces which are severely pushed. The cost is about £5 per ton in Germany.—*Journal of Gas Lighting.*

Chemical Exhibition at Manchester.

A permanent chemical exhibition has lately been inaugurated at Manchester, England, which already contains a large number of interesting objects, and it is expected the collection will constantly grow in value and extent. Among the novelties is a show of ozonized products from the St. Helen's Ozone Works, Plaistow. Among them is esparto pulp bleached by ozone. Where this agent is employed there is said to be absolutely no "going back:" in fact, an imperfectly bleached material will become whiter by standing, as though some residual ozone were slowly spending itself, and thereby gradually bleaching the fibers. Ozonized water, suitable for killing microbes, and for sterilizing purposes generally. Ozonized oil. This is available either for medical or manufacturing purposes. Ozone ammoniated lime, the peculiarity being that a considerable quantity of nitrogen is said to be fixed in combination with the lime. Ozone oxidized mangan, a high oxide of manganese, formed by the action of ozone on a lower oxide. A bleached solution of sugar. Before treatment with ozone this liquor was jet black. The bleaching may be performed either before or after boiling. It is also applicable to dry sugar of all grades.

Secrecy and Silence.

Aristotle, when asked the most difficult thing to execute, replied: "To be secret and silent."

It has so happened, sometimes, that the secrets of great discoveries have been so carefully guarded that for a season the most curious eye has been defeated in its efforts to pry into the shops and laboratories where the process of manufacture was executed. But seldom do manufacturers nowadays trust their secrets to the protection bolts and locks give them. They have found out that the best protection is a patent, which gives them a weapon with which to defend their interests which secrecy fails to do.

A New Helper in Photography—Acid-Sulphite.

We have now presented to us in a very convenient form a very strong solution of acid-sulphite of sodium, that in the compounding of developers will prove extremely useful. The material is in the form of a pale, yellowish fluid, smelling strongly of sulphurous oxide gas, with which it is saturated, and containing over fifty per cent of acid-sulphite of sodium in solution. That is to say, it contains half its weight of acid-sulphite of sodium, while ordinary sulphite of sodium in crystals contains half its weight of normal or neutral sulphite of sodium. From the nature of the two salts the acid-sulphite solution contains therefore twice the amount of the preserving element, sulphurous oxide, which the ordinary sulphite crystals contain. This would be true if the ordinary sulphite crystals were pure, but it is next to impossible to make them so, for they usually contain from four to six per cent of sulphate of sodium, and two or three per cent of carbonate of sodium. The new acid-sulphite solution contains a little sulphate of sodium, but the excess of sulphurous oxide gas with which the fluid is charged compensates for this.

Such is the new material placed in the hands of the photographer. Now a few words as to its uses.

The first important application of the new fluid is in the fixing bath. If to a quart of fixing bath (1 to 4) we add about 2 ounces of the acid-sulphite solution, the bath is rendered acid, but no change takes place otherwise. In this bath any negatives can be fixed, and with a rapidity and clearness that is really startling. Some of the slow varieties of plates are remarkably long in the ordinary bath before they are fixed nicely; but in the new acid-sulphite and hypo bath they fix in about one-fourth of the amount of time ordinarly taken. And what is yet more pleasant to note, they are remarkably clean and free from stain. In fact, they look exactly like plates developed with ferrous oxalate after they come out of the new bath, although they may be badly stained before fixing. The new fixing bath is beyond question the best remedy for stained plates from organic developers. One thing must certainly be remembered at all times, the fixing bath must be kept acid by the addition of new acid-sulphite solution from time to time, in order to have it maintain its efficiency as a clearing bath. If the proper care is exercised, the use of the alum clearing bath can be entirely omitted when the new acid-sulphite solution is used; thus eliminating a step in the present negative process when clear, crisp, and quick negatives are desired.

We must now say something about the application of the acid-sulphite to the developer. With pyrogallol the application is very simple; to every grain of pyro in solution add one drop of the acid-sulphite solution as a preservative. Thus, you may take—

Pyrogallol	1 ounce.
Acid-sulphite	1 "
Water to make	10 ounces.

This solution contains five and a half grains of pyro to the fluid drachm and will keep a long time. To develop: In one ounce of water use from one-half to one fluid drachm of the above solution, with from one and a half to two fluid drachms of alkaline solution, made as follows:

Sodium carbonate (crystals)	5 ounces.
Water to make	10 "

In the case of eikonogen it works equally as well as with pyro. In this case the formula becomes:

Eikonogen (finely powdered)	1 drachm.
Acid-sulphite	1 " (fluid).
Water to make	10 ounces.

Dissolve the eikonogen first, then add the acid sulphite. This solution contains three-quarters of a grain of eikonogen to the fluid drachm, and keeps as well as the pyro mixture above. In developing, if sodium carbonate is used, to every ounce of the eikonogen solution add from one to two drachms of the solution given above for pyro, and no water. If carbonate of potassium is preferred, use one to two drachms of the following solution:

Potassium carbonate (dry)	3 ounces.
Water to make	10 "

In each case the negatives come up clear and full of detail, without any tendency to fogging. Judged by experience with the ordinary developers, these new mixtures with acid-sulphite work a little more quickly; and if the negatives are fixed in the acid-sulphite fixing bath, the results leave nothing to be desired as to quality.

With hydroquinone we have not yet obtained any desirable results, the mixtures tried working much too slowly to be of practical use.

As the developers given above work more rapidly than those ordinarily employed, care must be taken in regard to the light used in the dark room, that it is of the proper non-actinic quality. It is best to use as little light as possible under any circumstances, but always enough to see what you are doing.

We are sure that those who use the new acid-sulphite of sodium will find it a great help to the production of clean, stainless negatives, closely resembling those of wet plate days.—*Anthony's Photo. Bulletin.*

Science and Hamadryads.

The dividing line, says the *American Analyst*, between vegetable and animal life is sometimes hard to distinguish, but the difference between average intelligence and scientific knowledge is easily enough detected. An illustration is offered in the following sapient extract from a recent letter to the Boston *Transcript:*

"What are you going to designate as the point which distinguishes animal from vegetable? Locomotion has been suggested, but that is no test. Certain small seaweeds have power of locomotion, while, on the other hand, the animal creature known as the ant's cow, from which that ingenious insect obtains its supply of milk, cannot move a particle. The more deeply science dips into the subject, the more inevitable does the conclusion become that life in the animal and the plant is precisely the same thing, and that vegetables possess in the fibers of their roots the same sort of intelligence that yourself and other human beings have in their brains. How do these root fibers know precisely which way to look for water? Plant instinct, perhaps, you will say. But instinct is only a vulgar term for inherited experience, which in itself implies consciousness. Oh, yes, vegetables have minds; at all events, scientific men have pretty generally come to that conclusion."

The Edison Phonograph in the Preservation of the Languages of the American Indians.

The present state of perfection of the Edison phonograph led me, writes J. Walter Fewkes, in *Nature*, to attempt some experiments with it on our New England Indians, as a means of preserving languages which are rapidly becoming extinct. I accordingly made a visit to Calais, Maine, and was able, through the kindness of Mrs. W. Wallace Brown, to take upon the phonograph a collection of records illustrating the language, folk-lore, songs, and counting-out rhymes of the Passamaquoddy Indians. My experiments met with complete success, and I was able not only to take the records, but also to take them so well that the Indians themselves recognized the voices of other members of the tribe who had spoken the day before.

One of the most interesting records which was made was the song of the snake dance, sung by Noel Josephs, who is recognized by the Passamaquoddies as the best acquainted of all with this song "of old time." He is always the leader in the dance, and sang it in the same way as at its last celebration.

I also took upon the same wax cylinder on which the impressions are made his account of the dance, including the invitation which precedes the ceremony.

In addition to the song of the snake dance, I obtained on the phonograph an interesting "trade song," and a "Mohawk war song" which is very old. Several other songs were recorded. Many very interesting old folk tales were also taken. In some of these there occur ancient songs with archaic words, imitations of the voices of animals, old and young. An ordinary conversation between two Indians, and a counting-out rhyme are among the records made.

I found the schedules of the United States Bureau of Ethnology of great value in my work, and adopted the method of giving Passamaquoddy and English words consecutively on the cylinders.

The records were all numbered, and the announcement of the subject made on each in English. Some of the stories filled several cylinders, but there was little difficulty in making the changes necessary to pass from one to the other, and the Indians, after some practice, were able to "make good records" in the instrument. Thirty-six cylinders were taken in all. One apiece is sufficient for most of the songs and for many of the short stories. The longest story taken was a folk-tale, which occupies nine cylinders, about "Podump" and "Pook-jin-Squiss," the "Black Cat and the Toad Woman," which has never been published. In a detailed report of my work with the phonograph in preserving the Passamaquoddy language, I hope to give a translation of this interesting story.

Floating Batteries for Harbor Defense.

The proposition of the Pneumatic Gun Company is to utilize the two old monitors, the Wyandotte and Nantucket, in demonstrating the merits of the system. These monitors are useless as they now stand, and are a dead expense to the government. The gun carriage company's plan is to remove the turrets and utilize the weights saved by putting in the hold high power 8 and 10 inch guns mounted upon pneumatic disappearing carriages. The guns are to be loaded, trained, and sighted below deck, and, upon command, to be thrown above deck and fired, the recoil sending them back in the loading position. The officers and crew are never exposed to fire of the enemy, and the guns but for a moment, when being fired.

The disappearing system of carriages has been adopted by the Board of Ordnance and Fortifications, and the plan of the company is to make these monitors moving forts, with the same system of disappearing carriages that has been adopted by the War Department for its fortifications.

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SEABURY BREECH MECHANISM FOR RAPID FIRING AND OTHER GUNS.

(*Continued from first page.*)

block with free turning movement. When the block is brought up by the shoulders of the tray, it has tripped the catch from the hook on the gun, and the whole mechanism swings around on the pivot clear of the bore. Meantime, during the turning of the block to unlock, the firing pin has been drawn or pushed back against its spring by a cam secured against the inner face of the rear recess in the block (not shown

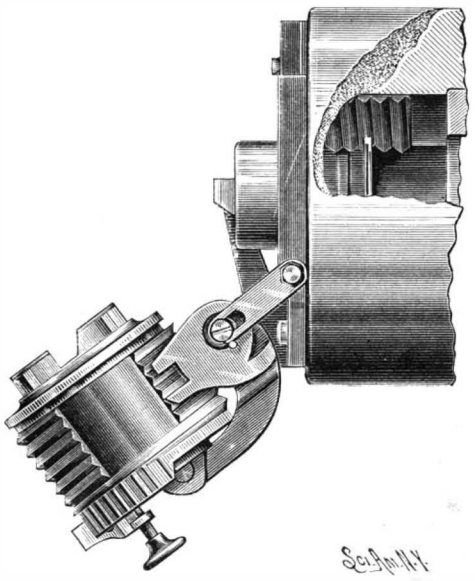

Fig. 5.—GENERAL PLAN OF BREECH, SHOWING BLOCK WITHDRAWN AND SWUNG ASIDE.

in the illustrations), and is caught in this position by a spring-actuated pin or trigger bolt. At the same time the projection or ring turned on the front end of the block has withdrawn the empty cartridge case from its seat by an amount equal to the pitch of the screw for that portion of a revolution—60°—about 0·1 inch, thus loosening it. When the mechanism has been swung clear of the line of the bore, the handle near the pivot strikes the short arm of the extractor lever, causing it to pull the extractor quickly to the rear and eject the empty case. At the termination of the operation of unlocking the block, the retractor bolt (shown on the side of the retractor near the letter G) is brought fairly under a hole in the wiper, E, and as the circular movement continues, this bolt is drawn upward into this hole by means of a pin working in a cam slot in the upper bearing (see Fig. 3), thus locking the retractor and wiper together. Obviously this locking together is of no service during the retraction of the block, but upon reversing the operation and closing the breech, it forms the connection whereby the movement of the handle, and consequently that of the wiper, is communicated to the retractor, and through it to the remainder of the mechanism. The trigger, J, on the rear face of the gun cannot be moved by the lock string, at K, until the return of the handle to the locked position, when the pin, I, is pushed in, and thereby the bolt released.

Another safety appliance is found in the cam which

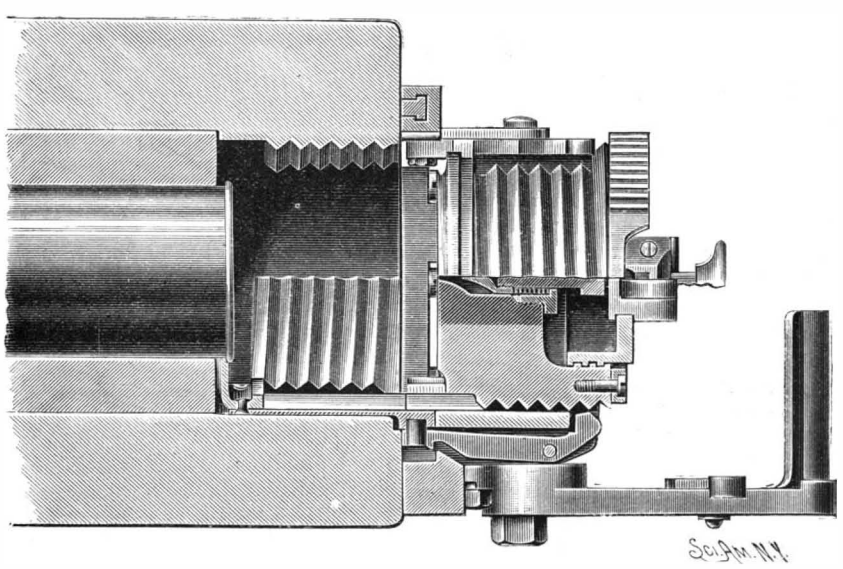

Fig. 6.—VERTICAL SECTION, SHOWING BLOCK WITHDRAWN AND CARTRIDGE CASE STARTED FROM SEAT—UPPER PORTION OF BLOCK IN FULL.

moves the firing pin to the rear, for until the block is locked the cam remains under the arm and shoulder of the firing pin, and even could the latter get adrift, the cam would prevent it from striking the cartridge primer.

Should it be desired to change from spring firing to an electric firing device, it can very readily be brought about without material alteration of the parts in connection with the firing device. Such a change would, in fact, be a move in the direction of simplicity, which is one of the points aimed at in this system. The chief difficulties that have heretofore prevented the introduction of rapid-fire guns on the slotted screw principle were met with in the comparative slowness of movement and the difficulty of providing a reliable and efficient extractor. Both of these objections have been overcome in the Seabury system, as has already been explained, and loading can be accomplished as rapidly as the cartridges can be brought to the gun, with the assurance that there will never be a doubt about the old cartridge case being removed upon the opening of the breech block. The advantages of this system are that all parts are easily made, and their number is comparatively small.

While the entire mechanism is simple in character, the mechanism is equally efficient for guns of larger caliber than those now embraced in the term rapid fire guns, since the reduction to one motion in opening and closing the breech block enables the simplest gearing for power to be employed. All parts are readily accessible for repair or cleaning. The parts are easily uncoupled by simply removing the main pivot. This advantage becomes more apparent in field use when it is desirable to disable guns hurriedly before abandoning. As against side systems it permits the use of the strongest known breech closure, embodying simplicity of manufacture, avoiding cutting through the side of the gun, with its attendant weakness, and smaller space occupied in the breech.

We are indebted to the representative owner of the system, Mr. J. W. Wilson, of 319 Broadway, New York, for the particulars from which the above article was written. The engravings were prepared from detail drawings and from a working model of the gun.

Injury to the New Cruiser Baltimore.

A report was received at the Navy Department recently from the civil engineer of the Norfolk Navy Yard, stating that the Baltimore was considerably strained when she was placed in the new timber dock there, causing quite a leakage before the water was all pumped out of the dock. A hasty examination showed that one or two seams in the amidship bulkhead had started, and calking was necessary in order to allow the vessel to go to sea.

A question immediately arose as to the cause of this, and a rapid survey of the dock was made. The civil engineer reports that, in his opinion, the bottom of the dock had settled about nine-tenths of an inch, while the Simpson Company, the builders of the dock, say they do not believe the dock has settled at all, and that if the ship was strained it was due to bad docking. This is most generally believed, for it is thought to be absurd that the settlement of a fraction of an inch, or even of two or three inches, in a dock 500 feet long would affect a vessel over 300 feet in length. A board will be ordered at once to investigate the condition of affairs. The dock was built last year and completed in September.—*Phila. North American.*

Utilization of the Power of Niagara Falls.

A scheme has been organized and work begun to generate electricity, by the aid of Niagara, sufficient to drive all the machinery in the mills and factories, propel every horse car, light up every street, avenue, and road in and around the village of Niagara Falls, the city of Buffalo, and the neighboring towns and villages. The present plans contemplate the production of 120,000 horse power, but there is no limit to the amount of power which may be produced.

The plan is to construct a subterranean tunnel from the water level below the falls about 214 feet under the high bank of the river, extending through the rock to the upper river at a point about a mile above the falls, where a head of 120 feet is obtained. The tunnel will thence extend parallel with the shore of the river one and a half miles at an average depth of 160 feet below ground and about 400 feet distant from the navigable waters of the river, with which it will be connected by transverse surface conduits. The fall of the water from these conduits into the tunnel —simply a tail race—produces the power, and the plans adopted will furnish 120,000 horse power.

The mill sites where this great power will be put to use are above the village, stretching along the level ground which bounds the river to the south, and from one to two and a half miles from the falls. Here a block of land has been acquired sufficient for mills which would employ the horse power mentioned and for mercantile and other needs of a large manufacturing town.

The Niagara Falls Power Company was organized on March 31, 1886, under the authority of the Niagara River Hydraulic Tunnel Power and Sewer Company, of Niagara Falls; capital, $2,000,000; president, Chas. B. Gaskill; treasurer, Francis R. Delano; secretary, Alexander J. Porter; attorneys, W. Caryl Ely, W. B. Rankin; resident engineer, Albert H. Porter.

A contract has been signed between the Niagara Falls Power Company and the Cataract Construction Company, of New York, for the construction of the main and cross tunnels, raceways, etc., the price being $3,500,000. This contract calls for the completion of the work by January 1, 1892.

The company has purchased about 1,300 acres for mill sites on the river front and on the line of the pro-

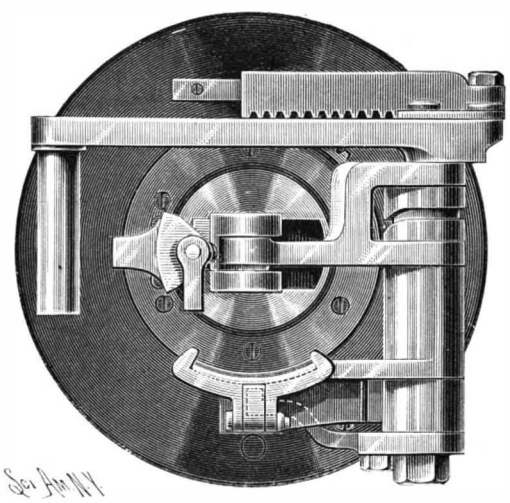

Fig. 7.—MODIFICATION—HANDLE AND WIPER COMBINED. CAN BE USED TO WORK EXTRACTOR.

posed tunnel, with ample streets and dockage, affording facilities for approach by rail or water, to accommodate 238 mills of 500 horse power each, or 119,000 horse power in all, which is the engineers' estimate of the capacity of the tunnel proposed to be built. Some idea of the magnitude and value of this power may be formed when it is stated that it far exceeds the combined available power in use at Holyoke, Lowell, Minneapolis, Cohoes, Lewiston, and Lawrence, and that it can be constructed at an expense not to exceed one-tenth of the outlay for the development of the power at the places designated.

The Accidents on the Eiffel Tower and Forth Bridge.

The great monsters of mechanical skill and genius call for the sacrifice of a great deal of life and limb in their construction. The greater the engineering feat, the more extensive is the loss of life.

In the construction of the Eiffel Tower, for instance, twenty-six lives were lost, according to the official returns of the French government, but it is said that this number would be largely augmented if the names were given of men who died from injuries received during the construction of the tower and of others who were killed and whose deaths were not reported, owing to the hue-and-cry which was raised after the first two dozen lives had been sacrificed on the great structure. The number of men who were injured dur-

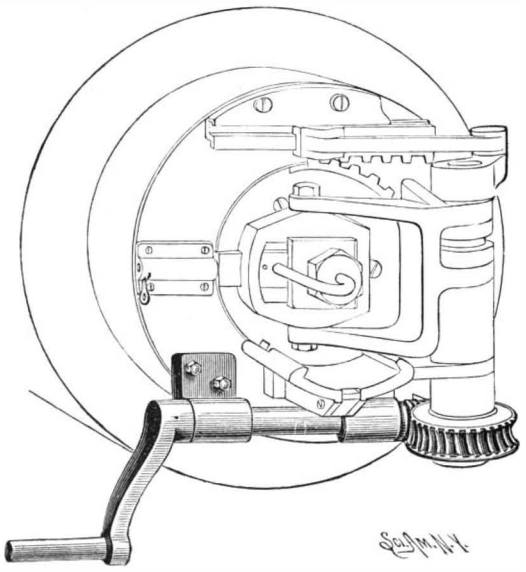

Fig. 8.—GEARING USED ON GUNS OF LARGE CALIBER TO WORK MECHANISM.

ing the construction of the Eiffel Tower has been placed at 6,000. This enormous showing is accounted for by the fact that every injury was reported and registered which received treatment from the official surgeons. When a man bruised his finger, he went to a government surgeon to have it dressed, and a clumsy workman thus got on the list a dozen or two times a year. Serious injuries were a very small proportion of the whole. On the great Forth Bridge in Scotland, a list of forty lives lost has been published, but there is no record of injuries.—*New York Sun.*

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A MODERN STAGE TRICK.

Those philanthropists and legislators who have of late been making a study of capital punishment will be interested, perhaps, in seeing a performance at Barnum's circus, in which one of the performers is executed twice every day. The means employed is the old fashioned "defunct" method of decapitation, and although this lacks the refinement and scientific precision of execution by electricity, it avoids, on the other hand, the delays and lawsuits that ordinarily attend this method of punishment.

The poor clown who suffers the death penalty twelve times a week usually enters the ring, and after performing certain acrobatic feats, commits some crime against his fellows, for which he is condemned to die. He is placed upon the block, his head is covered with a cloth. Harlequin approaches as executioner, and begins to cut with a huge knife across the victim's neck. In a moment all is over, the cloth is removed, and Harlequin lifts in the air the severed head. Delighted with his trophy, he carries it about under his arm, places it in a charger in the center of the ring, and finally takes it back to the block wrapped up in the cloth, and places it by the side of the headless trunk. He removes the cloth, and then in sport places a lighted cigarette in its mouth. In a little while you notice that the cigarette begins to glow, smoke comes from the nose, and the eyes roll. Evidently the head has come to life. Not able to bear the horrible sight, he throws the cloth again over the head, seizes it, places it in its original position on the shoulders of the victim, kneads it to the body, and suddenly the figure rises, head and all, and bows to the audience—an orthodox clown. The trick is a good one, and takes with the audience. The way in which it is done is explained in the lower cut.

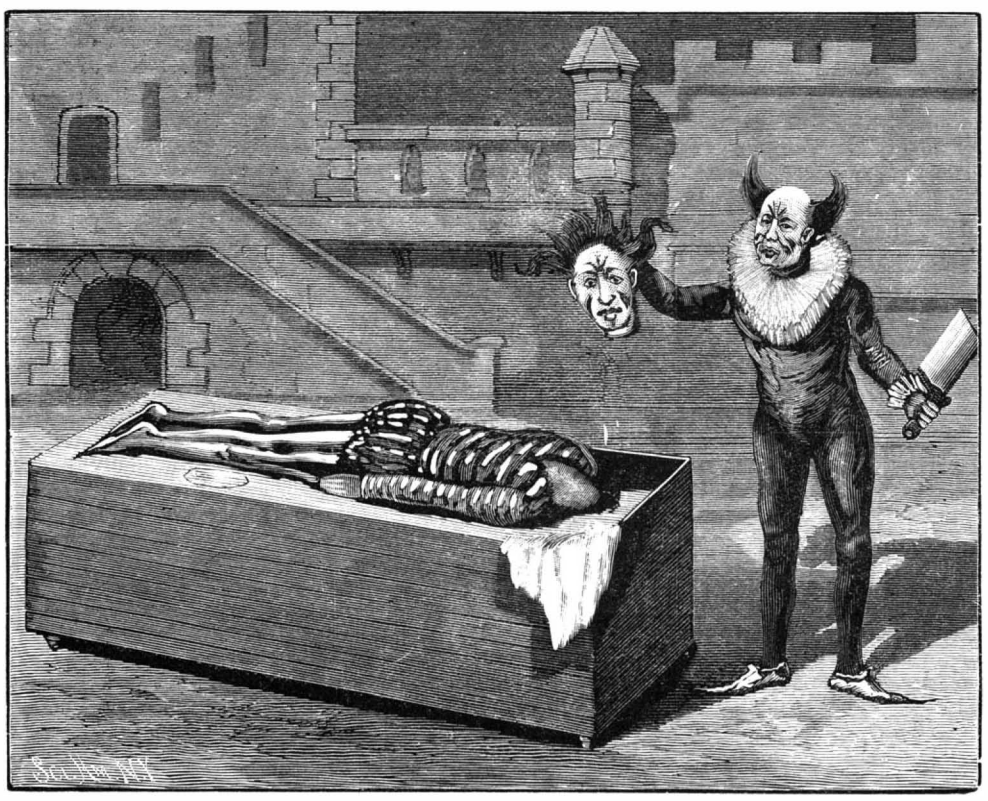

Fig. 1.—A NOVEL STAGE TRICK—DECAPITATION.

As soon as the clown lies on the box and his head has been covered with the cloth, he passes his head through an invisible opening in the top of the box. An assistant inside of the box passes up the dummy head, which is an exact fac-simile of the clown's head and face. This is seized by Harlequin, who makes such sport of it as he sees fit. When he places it by the side of the trunk, in reality he passes it through an opening in the top of the box to the assistant within, who substitutes his own head (which is painted to match the other two) in place of it. The other steps in the performance readily follow. The cloth which the harlequin always carries conceals all the sleight of hand, and the whole performance is a series of surprises.

Another performance of a somewhat similar character was recently performed at a theater in this city, in which a clown throws himself on a sofa and is cut in two by a harlequin. One part of the sofa with the body remains in one part of the stage while the other part with the legs and feet (which are all the time vigorously kicking) disappear through a wing at the other end of the stage. The action is very sudden and the effect startling. Of course in this case there are two men similarly dressed. The head and body of one of them appears at the head of the sofa, while the body of the second clown is concealed in the box under the seat at the other end of the sofa, the feet and legs alone being exposed.

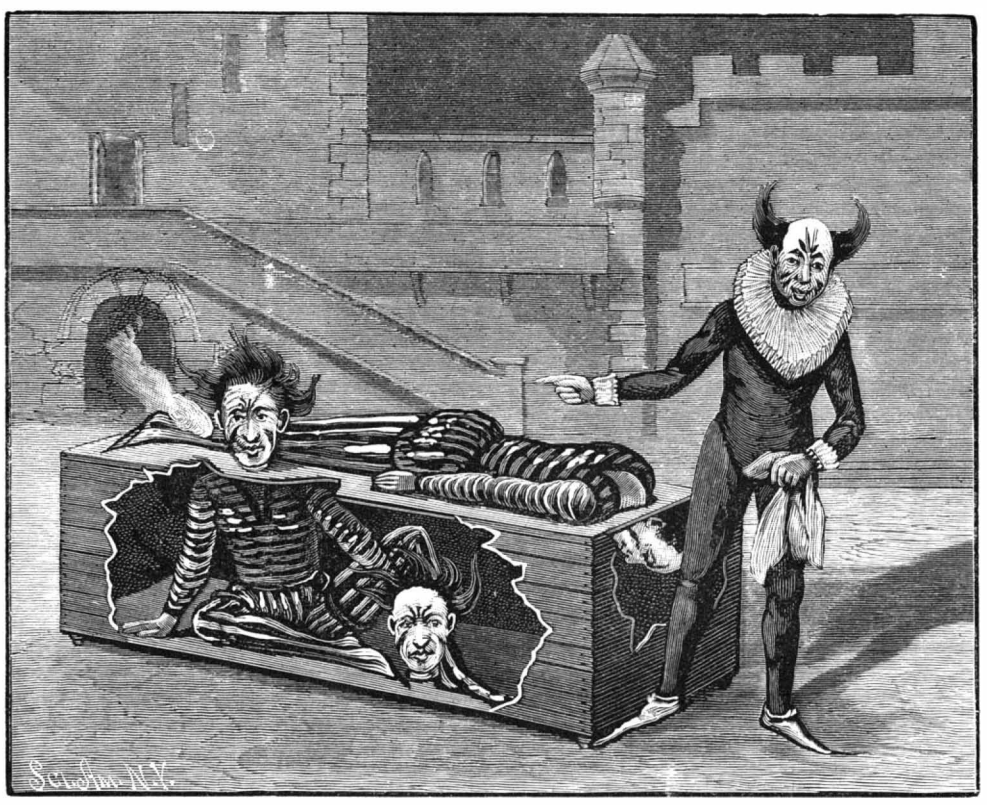

Fig. 2.—EXPLANATION OF THE DECAPITATION TRICK.

An Electric Fire Ball.

At Long Branch, N. J., April 27, during a rain storm, the 55 foot flagstaff about 50 feet away from Life Saving Station 2 on Sandy Hook was struck by a ball of fire as large as a barrel head. The topmast and main spar were shattered from top to bottom. Surfman Joseph Riddle sat at a window and saw the ball shoot from the eastern sky, preceded by a bright white light, which illuminated the vicinity of the station. Riddle noticed a black streak run down the topmast, and the ball of fire struck the mast with a report like that of a cannon. It did not linger as balls of electric light sometimes do, but disappeared like a flash of lightning. No thunder or lighting had been heard or seen before or afterward, and this did not resemble lightning.

Water Rights.

It is frequently claimed that those situated at the head of a fall have certain rights and privileges over those below them. Except in peculiar cases such is not the case. For instance, a party owning all the lands on both sides of a stream, both above and below the fall, may construct a dam and form a pond, and dispose of a certain mill site, and guarantee them certain rights in the use of all the water in the stream, should their necessities require it. He may also sell other sites with the privilege of drawing from the same pond, subject to the rights previously granted, and the party purchasing and accepting those conditions, which must be clearly specified in the deed, is bound to submit to those conditions; but other sites located upon lands below them and owned by other parties are in no way bound by such conditions as to the control of the water, but may demand the free and unrestricted use of the natural flow of the stream at all times; while those above them will be held to only a reasonable control of the water at any time.

The courts, in nearly every case where it is shown that water is used in an unreasonable manner or diverted from its natural source to the damage of mill owners, have promptly awarded damages for the same, and even the State has no legal right to grant the privilege of taking water from such lakes as are under State control, without the consent of the riparian owners of the lands situated upon the outlets thereof. —*C. R. Tompkins, in the Modern Miller.*

THE *Rural New-Yorker* thinks if those who have voted for the golden-rod to be the emblematic national flower were compelled to work a day or so pulling the weed out by the roots, they would change their votes.

Eugenol.

The oil of cloves has for a long time been used as a local remedy for the relief of toothache, but no scientific investigation as to the actual value of the local application of this drug has yet been reported. Liebreich and Langgaard state that the oil of cloves applied to the uninjured skin first produced reddening and then anæsthesia. Recently Dr. Leubuscher has determined the presence in oil of cloves of an active principle, which he terms eugenol. He has made a number of experiments as to the practical value of this principle, of which the following present his more important results:

Eugenol is a clear, dark yellow fluid, in its chemical composition allied to the higher phenols. In water it is insoluble, but readily soluble in alcohol and ether. It has an odor like the oil of cloves, and has also been described under the name of eugenic acid. If a drop of eugenol is instilled into the conjunctival sac of a rabbit, symptoms of irritation are first produced, the secretion of tears being increased, and the conjunctiva becoming somewhat reddened. After the first few minutes the sensitiveness of the cornea utterly disappears, while the conjunctiva is greatly depressed in sensibility, although not to the same degree as the cornea, the anæsthesia lasting for from ten to fifteen minutes. The deeper parts of the eye and the ciliary body are uninfluenced. In experiments to perform iridectomy in a rabbit under the influence of anæsthesia produced by eugenol, reaction occurred at the moment at which the iris was touched, while the division of the cornea was unassociated with any expression of pain. No after effects, with the exception of slight reddening of the conjunctiva, followed the use of eugenol; the cornea remained unclouded. Similar results followed the application of eugenol to the conjunctiva of the dog, although the symptoms of irritation were here somewhat more marked than in the rabbit. The influence of eugenol was also tested on the mucous membrane of the lips, tongue, and gum of man, and at first produced slight burning, and then considerable reduction in sensibility, lasting from five to fifteen minutes. Complete anæsthesia could not, however, be produced by this remedy. On the mucous membrane of the female genitals there was slight reduction of sensibility, produced through the use of eugenol, it being more marked on the mucous membrane of the vagina than elsewhere. Applied to the uninjured skin, neither burning nor reddening was produced, but slight reduction of the sensibility was produced in from five to six minutes. Although these results are not very striking, the author, nevertheless, tested the practical value of eugenol, and found that the best results were obtained when it was combined with a seventy per cent solution of lanolin ointment; applied to the skin in eczema, it reduced the severity of the itching; second, in ocular surgery, the use of eugenol is not to be recommended, since in man the instillation of a dilute solution of eugenol into the conjunctival sac produces severe reaction.—*Therapeutic Gazette.*

A Caution to Hard Drinkers.

Inebriates are always dangerous subjects to administer ether or chloroform for anæsthesia. In all cases the heart is weakened, and fatty degeneration of various degrees is present. Any substance which lowers its action is perilous, because of the inability of the heart to recover, and the tendency to paralysis. But drinkers have always fatty hearts, and sudden paralysis is likely to appear with the first inhalation of chloroform. In chronic cases of inebriety, where extensive organic changes have taken place in the brain and spinal cord, paralysis of the respiratory centers occurs first, and respiration stops before the action of the heart. In such cases artificial respiration may prevent death if promptly used. In all cases a sudden checking in respiration and heart beat where ether or chloroform are used is a danger signal of the gravest importance.—*Quarterly Journal of Inebriety.*

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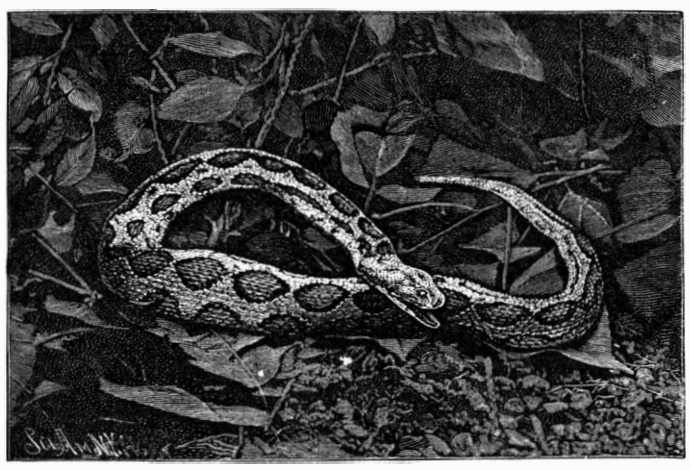
A VENOMOUS CEYLON SERPENT (*Daboia Russelli*).

The accompanying photograph presents one of the most deadly of the Indian serpents.

It belongs to the genus *Daboia*, sub-order *Viperidæ*, and was named for its chief investigator, Dr. Russell, *Daboia Russelli*,* although it is also known by local synonyms as tic polonga, uloo-bora, jessur, and sea chunder.

Sir Joseph Fayrer, as well as Dr. Russell, places it next to the cobra de capello in lethal power, and it is certainly nearly as venomous as that more famous *Naja tripudians*.

The *Daboia* is a very beautiful snake. Its groundwork of color is light chocolate brown, and down the body length run three parallel successions of black diamonds, slightly elliptical, edged with white and retaining the brownish yellow groundwork in their centers. Upon the head, the snout is marked by two lateral converging yellow lines. The labial and rectal shields are yellow, with brown margin, and behind the eye a triangular brown, black-edged spot; ventral surface yellowish, or marbled with more or less numerous semicircular brown spots on the hinder margins of the ventral shields. For a part of the above description I have used Sir Joseph Fayrer's admirable article in the January *Eclectic* ("The Venomous Snakes of India," page 90).



VENOMOUS CEYLON SERPENT (DABOIA RUSSELLI.)

This deadly viper was killed in a hedge near my room on the north side of the American mission compound in the Tamil village of Batlicotta, Jaffna, Ceylon.

It struck furiously at the attacking long pole, and hissed and blew vigorously. A subsequent examination proved the *Daboia* about 35 inches in length, a female with young. The faugs were about ½ inch in length, white, recurved, movable, set in the maxillary bone, and tubular with involuted edges, and openings at the base and apex of the fangs, respectively triangular and circular, but very small.

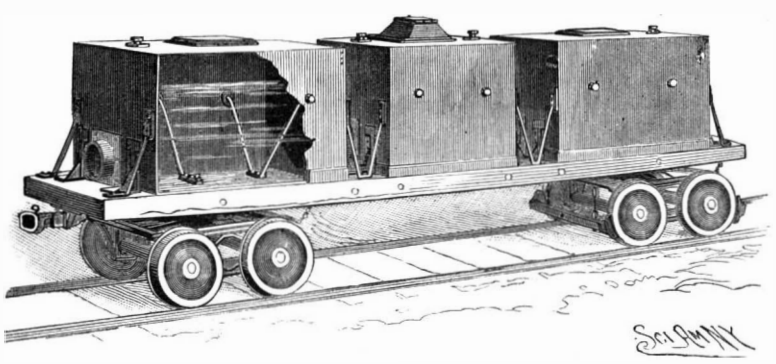
The poison is known as "venom globulin," of which it may contain 25 per cent. It is a fatal blood poison, producing complete fluidity, early paralysis, and intense respiration, which continues longer than in the case of an organism venomized by the cobra, however, whose lethal power is nervally terrible. *Daboia* venom causes convulsions, but does not select nerve centers immediately. Turkeys and hens have died in less than 60 seconds when bitten by this reptile, and men in less than an hour. The best antidotes are probably potassic permanganate, sodic hydroxide, ferric perchloride, and hydrofluoric acid. In India and Ceylon invariable caution is positively imperative at night in field or room. This can be easily appreciated when I state that in a period of fourteen months I have killed twenty-eight serpents.

W. D. MARSH.

Jaffna College, Ceylon.

AN IMPROVED PETROLEUM CAR.

The invention herewith illustrated is designed to provide a car with a series of connected metal tanks so braced that their walls will not bulge when heavily loaded, while the bulk of the weight is over the car trucks, and the tanks are capable of rigid attachment to either a flat or gondola car. The invention has been patented by Messrs. William H. Hill and Charles W. Bender. The tanks are ordinarily arranged in sets of three, the outer tanks being the largest, and, to prevent their sides from bulging outward, each tank has at each side two interior stay rods, secured to the sides and bottom of the tank. The ends of the tanks are also braced on their outer faces, the upper ends of the brace rods being bolted to re-enforcing plates as well as to the tank, while their lower ends have a horizontal section attached to a connecting plate, which connects the bottoms of the tanks and virtually forms a portion thereof. There are two sets of connecting plates secured to the car bed in any suitable way. The end tanks are connected to the intermediate tank at or near the bottom by horizontal tubes. On the top of each tank are one or more air vents, and each end tank has a large top opening, with tightly fitting cover, whereby all the tanks may be quickly filled or emptied when desired. The central tank also has a top opening with a hood-like hinged cover, there being in the bottom of the hood a tube to admit of the application of a pump to the central tank, whereby the liquid may be discharged from all the tanks, or through which the tanks may all be filled.



HILL & BENDER'S PETROLEUM CAR.

For further information relative to this invention address Mr. William H. Hill, No. 35 Taylor Avenue, Utica, N. Y.

THE *Journal de la Chambre de Commerce de Constantinople* says a company has been formed in Paris for working products derived from chestnuts, and chiefly the production of alcohol from chestnuts.

* In Tamil known as *mutthedi purdion*, stamp snake or picture viper.

Our Census of Manufactures.

On the 2d day of June the work of collecting statistics of manufactures for the report of the eleventh census will be inaugurated throughout the entire country. The value of this report must depend wholly upon the accuracy and thoroughness with which manufacturers answer the questions propounded.

The personal interests of every manufacturer are involved in the character of the report on manufactures. It will be quoted for the next ten years as the official announcement of the *exact* industrial condition of the country, and will be the basis for any future legislation that may be enacted in regard to the wants of our people, whether engaged in agricultural or mechanical pursuits. Therefore it is of vital importance to each manufacturer that an accurate report shall be made.

The superintendent of the census has taken every possible precaution in the preliminary work to make this census complete and satisfactory, and the earnest co-operation of those engaged in productive industry is all that is now necessary to secure valuable results.

Every manufacturer should bear in mind that his answers to the questions relating to his business are held strictly confidential, are not disclosed to any competitor or to other persons, and are not used by the government as predicate for the purposes of taxation or license, or in any way to adversely affect his individual business. This assurance is printed on each schedule over the signature of the superintendent of census.

The expert special agent in charge of this branch of census work, Mr. Frank R. Williams, has personally visited the principal manufacturing centers and consulted representative manufacturers, the publishers of trade journals, and practical business men generally, for the purpose of ascertaining the proper scope of the inquiry for each branch of manufacture. The questions contained in the census schedules are those suggested by the manufacturers and other persons most interested in the progress of the country, and cover ground absolutely essential to the proper presentation of its industrial conditions and resources.

The Mechanic Honored.

The following epigrammatic paragraphs are selected from the *Iron Industrial Gazette:* Let mechanics cease to bewail the obscurity of the mechanic. To-day, even in Europe, let the question be asked: "Who are the most remarkable men in the United States?" and the answer will be, not the statesmen, not the millionaires, the two classes generally most envied because the least understood, but the "mechanics," the Edisons, the Roeblings, the Westons, the Westinghouses, and others who have made the name "American mechanic" so great a title of honor, so pronounced a synonym for progress, power, enterprise, and utility that, when the American mechanic goes to Europe, he goes as the guest of rulers, as the lion of society, as the hero of the learned.

Any mechanic who feels like despairing because the world has not gone well with him should try, first of all, to figure out to what extent the world is to blame for his failure, and to what extent he himself is to blame. If he has not fitted himself for success, it is his own fault that success has not come to him.

The mechanic who is looking for outside things to lift him to success is looking for the improbable and the impossible. It is inside things that count in the problem of a worker's life, thought, careful planning, intelligence, and knowledge. These things are at the command of all. The workers who refuse to use the weapons cannot expect to win the spurs.

Generally, the more a mechanic works his chin, the less he works his hands. The more he knows about the best way to manage the universe, the less he knows about his lathe, his drill, or his planer. The more perfectly he could run the government, and the more money he could save the country, if he had charge of the whole business, the less likely he is to be a good workman. The more he prates about the terrible dishonesty of the public servants, the more incapable will he be of understanding that it is dishonest in him to rob his employer by wasting in idleness the time which he is paid to spend in labor, or by wantonly wasting stock, or needlessly injuring a valuable machine by careless handling. If I had the hiring of a million workers, I would try to find out which of them were agitators, orators, socialists, anarchists, and talkative cranks in general, and I would pay them a salary to remain away from my shops rather than have them around talking my plant, my other employes, and my business to death. Some inventor ought to bring out a patented talk squelcher. There would be millions in it.

John T. Wood.

Mr. John T. Wood, the explorer of Ephesus, died recently in London at the age of seventy. Mr. Wood was trained as an architect, and had won a considerable reputation, when he was engaged as architect to the Smyrna & Aidan Railway, and, in that capacity, took up his residence in Asia Minor. Here he became interested in the antiquities of the country, and, after a year's service with the railway company, resigned his position to devote himself to antiquarian research. His most noted work was the excavation of the Temple of Diana at Ephesus, one of the most splendid and famous structures of antiquity, and, although the incendiary Herostratus and the pillagers who succeeded him had done their work effectually, he found remains enough to determine the arrangement of the building and to restore much of its detail. The manner in which this investigation was carried out gained Mr. Wood a high place among archæologists, and for many years he has been, perhaps, the principal authority on the architectural work of the Asiatic Greeks.—*Amer. Architect.*

Use of Flax Straw.

The Standard Fiber Ware Company was organized at Mankato, Minn., late in 1885, with a capital of $50,000, for the manufacture of flax fiber into pails, wash basins, and like articles; a plant was built, and goods began to be turned out the following year. It required some two years of experimenting to reach satisfactory results, but these were finally attained, and the goods are now said to be very satisfactory. They are light, strong, handsome, and cleanly. The wash basins do not rust out or slip from the fingers and break. The water pails, in the language of those who use them, are the "only pails fit to hold drinking water." The dairy pail will not taint milk, get sour, or need scouring. The slop jars never lose their paint or decorations like tin, or break like crockery. The spittoons are serviceable and easy to clean. The inside finish is paint (without white lead) or Japan finish, according to the use it is to be put to. The outside finish is such as to suit all tastes, in colors and decorations. All paints, japans, copals, and decorations are baked on to stay. The process of manufacture starts with raw tow from the Dakota prairies, passes through the beaters, bleach tubs, pail machine, presses, calenders, trimmer, corrugator, bottomer, hooper, the intensely hot water-proofing bath, the bakings and rebakings, of water-proofing, paints, japans, decorations, and copals; all of which unite to make ware with a body and a finish that is practically perfect; in the words of an enthusiastic salesman, "the ware of the future."—*Paper World.*

THE Weisswasser paper and cellulose manufacturers have just introduced into the market, under the names of uni-colored and two-colored water-tight cellulose papers, a cellulose material that can be applied to the most varied purposes. The cellulose paper can be used for book backs, table cloths, and as a temporary covering for roofs, as well as for packing goods. It can be laid on damp walls and as a coating for maps, in short, its applicability is extraordinarily manifold. This cellulose paper is far cheaper than parchment. It does not become sticky through heat, nor does it crack from the cold, as is the case with oil cloth. The disagreeable asphalt odor is not perceptible.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — Marion M. Green, County Line, Tenn. This invention covers a novel combination and arrangement of parts designed to form a simple and effective car coupler which can be easily and quickly operated either from the top or sides of the car, thus obviating the necessity of going between the cars to couple them.

PNEUMATIC RAILWAY. — George W. King, Washington, D. C. This is a system in which a compressed air conduit is buried between the rails, having on its upper face a continuous slot, with devices between the car and the air tube whereby a continuous air pressure is supplied to the motor and undue friction avoided.

HOSE COUPLING FOR CARS. — Conrad Eckhard, Friend, Neb. The drawheads are provided with transverse passages registering with each other when the drawheads overlap, and there are valves in the passages with laterally extending automatically operated arms to project over the meeting edges of the drawheads, and other novel features, whereby the device automatically couples the ends of the hose when the two drawheads come together.

CATCH FOR CAR DOOR BRACKETS. — Ferdinand E. Canda, New York City. This is a gravity catch pivotally connected to a bracket arranged for connection with a car door, the catch being adapted to engage the ordinary bottom door track, which in this case becomes a keeper rail, the device being designed to obviate the difficulty sometimes experienced in opening freight car doors when the freight is lodged against the inner face of the door.

Mechanical.

COMBINATION TOOL. — Marion M. Green, County Line, Tenn. This is an implement designed to afford a simple and convenient saw set, wire cutter, leather punch, hammer and nail extractor, grippers for horse shoeing, wrench, pipe cutter, screw driver, etc., all in one tool, particularly adapted for use on farms having wire fences, and capable of being strongly and cheaply made.

SAW MILL DOG. — Alfred K. Miller, Millersport, Ohio. This device consists of a bar mounted to slide on a frame and carrying an adjustable hook, a gear wheel being mounted on the sliding bar and rack, being fastened on the main frame in which the gear wheel meshes, the dog when set being adapted to hold the log or lumber firmly in place on the saw mill carriage.

CAN CAPPING MACHINE.—Simon Lake, Baltimore, Md. In this machine the cans are fed to place and the caps held on them while the solder is cut and delivered to irons heated by a gasoline flame which distribute the solder along the margin of the cap and the surface of the can with which it contacts, the design being to greatly facilitate the work and reduce the labor of capping.

BORING MACHINE.—Charles H. Irwin, Friederich Mill, and John E. Hitch, Wilmington, Ohio. This invention consists of a shaft mounted to be shifted and carrying two gear wheels, a second shaft carrying two gear wheels being adapted to be thrown alternately in contact with the first gear wheels by shifting one of the shafts, to change the speed of the machine, to run slow when a large auger is used and run fast with a small auger.

BOLT HEADING DEVICE. — Emil Hubner, New York City. This is a device for use in connection with any bolt-making machine operated by a lever or treadle, and is designed to quickly head a bolt with the least possible manipulation of the rod from which the bolt is formed, while the sections of the gripper are interchangeable and each part is designed to be of maximum strength.

CLAMP. — William Carroll, Columbus, Ohio. This is a bench clamp for pattern, cabinet and box makers, and also for the use of stool makers, to hold the doors and other parts in place while fitting on pintles, hinges, etc., and consists of a spring-pressed rod held to slide in a casing, a head held on the rod, and a table held on the casing.

BOLTING REEL. — Riley A. Stubbs, Greenville, Ohio. Combined with the reel are transverse dividing boards through which the reel passes freely, there being a fixed rail on which the boards travel longitudinally, and gates held below and actuating the dividing boards, with other novel features, designed to prevent the accumulation of flour in the hopper and prevent leakage from the gates.

LOOM MECHANISM.—John Riddiough, Bloomington, Wis. This is a take-up mechanism in which the cloth beam has a ratchet and there is a breast beam in front of a reciprocating lay, combined with a lever having a pawl engaging the ratchet and a laterally extending pin, a rod being pivoted at its forward end to the lay and having a slot at its rear end to receive the pin, while a spring or weight throws the pawl lever forwardly to rotate the cloth beam.

Agricultural.

HARROW.—William S. McCord, Gratz, Ky. This invention is in the class of soil pulverizers having a series of convex-edged cutting blades instead of teeth, the improvement consisting in the form and arrangement of the blades or cutters, whereby they are adapted to cut, pulverize and turn the soil in a superior manner.

BAND CUTTER AND FEEDER. — Mike Ryman, Warner, South Dakota. This is a device for attachment to the rear end of a thrashing machine, embracing a knife shaft with fast rotary motion and a feed shaft with slow motion, and other novel features, to conveniently cut the bands of the sheaves of grain and distribute the latter equally to the beating drum of the thrashing machine.

CENTER CUT MOWERS. — George W. Sturm, Dana, Ind. This is an attachment especially adapted for use in winnowing clover, and is designed to keep the heads and leaves for a time out of contact with the ground and afterward deliver the cut clover in rows upon the ground in complete condition for the huller.

Miscellaneous.

METALLIC BUGGY BED. — William L. Dearth, Frankfort, Ind. This buggy bed is formed of a single piece or sheet of metal, cut at the corners, and the ends and sides bent up and the corners lapped and fastened by being brazed, riveted or bolted, being designed to stand hard usage better than is possible with a wooden vehicle bed.

OPERATING GAS ENGINES. — John J. Pearson, New York City. This invention covers a method of operating the engine by holding open the valve in the passage between the power cylinder and the reservoir when no explosions are required, and rendering the igniting apparatus inoperative, so that the contents of the power cylinder may pass freely into and out of the reservoir when the engine is running by its own momentum, thus avoiding undue absorption of power in the compression of the gases.

GASOLINE TANK. — Charles A. Rice, Philadelphia, Pa. This is a tank especially adapted for use as a reservoir for gasoline stoves, preventing leakage, and so made that, when the storage section is removed from its casing for refilling, the valves will be automatically closed, and when the section is replaced the valves will be automatically opened to the feed pipe of the stove.

ANTI-FRICTION BEARING. — Seely W. Ashmead, St. Louis, Mo. This is a ball bearing in which the base has recesses, each shaped to a section of a sphere, while there is an apertured covering for the base allowing a small section of the ball to project through each opening, the device being designed for use with railway rolling stock, on turntables, and with general machinery.

TILE KILN. — Henry Moehle, St. Mary's, Ohio. This is a kiln in which the deflecting and burner walls are connected with a series of burners passing longitudinally through and into the kiln, the burner walls being extended the entire width of the kiln transversely to the burners and connected with the deflecting walls, the burners extending outside of the main walls of the kiln, the fires being allowed to burn until the "water smoke" is seen, when the fires at the burners are weakened or strengthened as deemed necessary.

VEHICLE HAY LOADERS.—William A. Barber, Savanna, Ill. This is a device adapted for attachment to a hay wagon, whereby a hay loader may be coupled thereto or uncoupled therefrom by the operator when upon the load, whether the team be moving or standing still, the invention covering various novel features of construction and combinations of parts.

HEATING TIRES. — Luther Simmons, Buckner, Mo. This invention provides for a circular closed heating chamber, mounted on wheels, to receive the tires to be heated, and adapted to be readily located in proximity to a forge fire, with a hood and pipe to receive the blast from the fire and convey the gases and products of combustion around the interior of the chamber, discharging them thence through the forge flue, and is designed to save time and fuel.

TIRE TIGHTENER.—William A. Mayo, Paris, Texas. This invention consists of a plate having wedge-shaped projecting fingers and a rearwardly apertured extension, with other novel features, whereby, as the spokes of the wheel become loosened in their socket connection with the felly, they may be quickly tightened without disconnecting the spokes from the felly sections.

OAR LOCK.--George N. Spaulding and Charles H. Eaton, Harrison, Me. This invention covers a simple and novel form of construction by which the oar may be readily locked in place to prevent longitudinal slip, while allowing a free sweeping action as well as a proper locking of the blade to feather it when necessary.

STORE SERVICE APPARATUS.—Edward A. Rorke, Brooklyn, N. Y. This is a buffer for double track store service railways, consisting of an automatically closing stop located between the track rails, and mechanism for opening the stop, by means of which the carrier will be effectively stopped and released to proceed on to an elevator or switching shelf.

MAIL BAG. — Charles Van Inwegen, Mongaup, N. Y. This is a pouch having a draw strap applied to its center, in combination with a grip comprising two blocks, each attached to the bag and hinged to each other and formed with square meeting faces normally held in contact with the draw strap by springs applied to the blocks.

LEAD PENCIL. — Lewis H. Sondheim, New York City. This invention relates to a class of pencils in which the lead or crayon is projected by a "step by step" movement as it is worn away by use, the invention being designed to provide a simple, efficient, and easily adjusted pencil of this kind.

PIPE ORGAN. — Romaine Callender, Brantford, Ontario, Canada. This is an instrument designed to permit the performer to set consecutive combinations of registers preparatory to execution of the music, and while playing the organ the several combinations can be produced consecutively without much physical exertion by the performer, so that the latter is enabled to pay more attention to the music score.

FINGER RINGS.—Joseph B. Bowden, and Hermann V. Bernhardt, Brooklyn, N. Y. This invention covers a machine for rapidly and accurately shaping finger and other rings to any desired size, the invention consisting of a grooved circular die mounted to turn and adapted to engage the outside of a ring to be rolled, and a second circular die traveling at a differential rate of speed, adapted to engage the inside of the ring.

STAMP AFFIXING MACHINE.—John M. Mast, Cambridge, Pa. This is a machine for quickly and conveniently attaching postage stamps to envelopes, etc., and has a fixed knife in the rear of a head over which passes the strip of stamps, a device for feeding the strip forward at each upward stroke of the head, a swinging moistening device, and other novel features.

FENCE POST.—William H. Thomson, New York City. This is a post made of T-iron and apertured to receive anchor pins, provision being made for locking the anchor pins after they have been adjusted to place, the posts being quickly and readily set up without much digging and rigidly held against displacement.

SHOVEL AND SIEVE.—Edward Fleming, New York City. This is a combined implement consisting of a shovel having an open work bottom and a receptacle for dust and ashes detachably held thereto, both the shovel and ash receptacle tapering toward the front, enabling them when connected to be used as a shovel.

EXTENSION STEP LADDER. — John L. Wolf, New York City. This ladder is made in two or more sections, the extension sections of which are capable of closing upon the main or upper section to form a ladder of moderate length, or of sliding out from the main section together or singly to increase the height of the ladder.

WASH TUB.—Harriet Johnson, Brooklyn, N. Y. This invention provides means whereby the stationary wash tubs ordinarily in use in tenement or flat houses may be utilized for bath tubs when desired, the partitions being made removable and a locking device and packing strip employed in connection therewith.

MAKING ELONGATED TUBS. — Levi E. Flint, Ashby, Mass. This invention covers a method of making bathing tubs, etc., by first turning a round tub, then dividing it through its middle and uniting the half-round tub sections with an interposed bottom and sides and securing the whole together.

REVERSIBLE FEED MECHANISM FOR SEWING MACHINES.—Adolph Pettenkofer, Brooklyn, N. Y. Combined with the feed bar is a shaft having a cam for moving it lengthwise, and a cam for vibrating it automatically adjustable about the shaft, with a locking device for releasing and locking the automatically movable cam in adjusted circumferential position on its shaft, whereby the direction of the feed may be reversed without stopping the machine or altering the position of the material worked upon.

DISH WASHING MACHINE. — Thomas A. and Herbert W. Pudan, Sacramento, Cal. Combined with a water-holding chamber and a support for the articles to be washed is a revoluble shaft with a rotary brush, and other novel features, the invention being an improvement on a former patented invention of one of the same inventors.

BURGLAR ALARM. — John H. Bleoo, Brooklyn, N. Y. This invention provides a spring attachment to be set from the inside of a door or window, thus permitting the outward passage of an inmate of the house, but sounding an alarm should the door or window be opened after the setting of the alarm.

TROUSERS.—Emil E. Ehrmann, Terre Haute, Ind. These trousers have an improved back strap and means of securing it to the garment, whereby it will serve to tie the waistband to the body of the garment, and the two will not be parted when a severe strain is put upon the rear suspender buttons.

FIELD MOUSE TRAP. — Hermann Rippke, Ober-Faschkittel, near Olbendorf, Prussia, Germany. The frame of this trap has a pair of opposing spring arms and a vertical spiral spring, a plate being attached to one of the arms having a pointed forward end and a toothed opening, a lip at the rear end of the plate being detachably engaged with the other spring arm, the trap being readily fixed in position to prevent displacement by mouse-hunting animals and birds.

HECTOGRAPH PRINTING PRESS. — Henry H. Harrison, New York City, and Frederick C. Buffum, Stanton, Fla. This is a machine in which the hectograph material is applied to a cylinder or sleeve to be placed loosely on a printing or copying roller resting against the impression cylinder, whereby new copying cylinders may be readily supplied, the paper being fed from a reel and the sheets cut by shears as the paper issues from the machine.

ELECTRIC LOCKING ATTACHMENT. — Hermann J. Meyers, Brooklyn, N. Y. This invention provides means for retaining a door in open adjustment and for quickly closing and locking it by a push button or circuit closer at the rear of the counter or other suitable place, whereby the means of ingress or egress will always be under the control of an operator at any desired point at a distance from the door.

PORTABLE BOTTOM FOR COKE OVENS. —David Evans and Albert W. Adams, Pittsburg, Pa. This is an improvement on a formerly patented invention of the same inventors, providing a bottom which will permit the surplus water thrown upon the coke to cool it to flow off, and to facilitate the raising and lowering of the bottom, the bottom being lowered upon a car after the charge has been coked and moved bodily from the oven.

DRAUGHT REGULATOR FOR SHIPS' GALLEYS.—Ali Malekh, New York City. This invention consists of an air deflector and support combined with the exposed part of the galley pipe, the deflector being arranged to convert the back currents from the sails into a continuous draught, and also to catch the headway wind, giving a good draught in all directions of the wind, however the sails may be set.

ANCHOR ATTACHMENT. — Howard L. Moule, Rock Creek, Wyoming Ter. This is a clamping gravity block secured in place to embrace the crown and shank of the anchor, whereby the weight of the crown piece will be so increased as to insure the embedding of the flukes and proper retention of the anchor, increasing light anchors in weight at a point where such increase will render the anchor more efficient.

WAGON BRAKE.—Noble E. Thompson, New Mayville, Pa. This is a brake with which the applied draught will automatically remove the brake shoes from the wheels as the wagon is drawn forward, and when descending an uneven surface the action of the horses in holding back will apply the brake shoes to the wheels, the brake shoes being thrown out of contact when the wagon is backed.

TRANSFERRING APPARATUS.—William C. Hanson and Leonidas C. Ferrell, New Orleans, La. This invention covers a wagon truck with suitable restraining devices, a railroad truck with vertical standards, a derrick over the railroad truck with suitable lifting mechanism, and a wagon body detachably held on the wagon truck, to be bodily lifted on to the railroad truck, with other novel features.

SPOOL THREAD CABINET.—James W. Hayden, Lewisport, Ky. This cabinet has parallel series of spool-receiving compartments, with inclined chutes, and other novel features, wherein the spools cannot jam, and so that by pulling a numbered button a correspondingly numbered spool of thread will be delivered, provision being also made for the stowage of surplus spools, and conveniently returning spools that have been withdrawn.

SEWER GAS EXCLUDER.—Francis B. Herbert, Hoboken, N. J. This is an attachment for wash basins, comprising a buoyant waterproof flap with eyes along its upper edge and hangers adapted to fit in the uppermost overflow apertures of a basin and hold the flap over the apertures, the flap rising to permit the overflow of water, but keeping the apertures closed at other times.

CORSET FASTENING. — Thomas J. Brough, Baltimore, Md. In this fastening the busk has at its opposite ends positive keepers adapted to receive the end eyes, with spring-actuated latches, there being intermediate locks between the end locks, with other novel features, whereby the corset may be conveniently fastened and unfastened, and will not accidentally unfasten, one fastening not being liable to loosen as the others are being fastened.

FIRE CRACKER PISTOL. — George W. Ogle, Morgan Park, Ill. This is a breech loading toy pistol in which fire crackers may be used to project a harmless missile, its barrel and stock being made in one piece, with simulations of a sight piece, trigger and hammer, and the bore of the barrel communicating at its rear with an upwardly and outwardly curved loading aperture of less diameter than the bore.

SCIENTIFIC AMERICAN
BUILDING EDITION.

MAY NUMBER.—(No. 55.)

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1. Elegant plate in colors representing a tasteful cottage of moderate cost at Buffalo, N. Y. Perspective elevation, floor plans, sheet of details, etc.
2. Colored view of a residence at St. George, Staten Island, N. Y. Estimated cost $20,000. Floor plans, perspective elevation, sheet of details, etc.
3. Stone residence, corner of St. Nicholas Place and 150th Street, New York city. S. Burrage Reed, architect.
4. New buildings at Eastgate and Bridge Streets, Chester.
5. Engravings of the residence of J. M. Johnson, Binghamton, N. Y. Perspective elevations and floor plans. Cost $19,000 complete.
6. Perspective view of the office buildings of the Gotthard Railroad in Lucerne.
7. An English cottage. Perspective and floor plans.
8. A cottage recently erected at Binghamton, N. Y., cost complete $3,800. Plans and perspective.
9. A residence in the Gothic style erected at New Brighton, S. I. Floor plans and perspective.
10. Excellent design of a country house recently erected at Belle Haven, Conn. Cost $14,250. Oscar S. Teale of New York, architect. Perspective views and floor plans.
11. A double dwelling at Yonkers, N. Y., erected at a coss of $8,000. Plans and perspective.
12. Residence of Chas. Kappes, Esq., at Stapleton, Staten Island, N. Y. Cost complete $4,000. Perspective elevation and floor plans.
13. Cottage at Greenwich, Conn., erected at a cost of $7,250 complete. Floor plans and perspective.
14. Miscellaneous Contents: High buildings. — Bad flues.—Imitation ebony.—Destruction of asphalt pavement by gas.—Art of building.—Improved dumb waiters, illustrated.—An improved skylight, illustrated.—Rogers miter planer, illustrated.—Dumb waiters and hand power elevators.—A fine window in the Convent of the Sacred Heart, illustrated.—Improved sash pulleys, illustrated.—A hot air and hot water heater, illustrated.—Colors for mortar.—Improved adjustable grooving head, illustrated.—An improved window screen frame, illustrated.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(2191) F. H. W. writes: Can you tell me something that I can use to coat either zinc or wood that will not be affected by acids or chemical action of any kind? It is for a photographer's sink that I want it A. Use wood, and smear over with 4 parts resin, 1 part gutta percha and a little boiled oil, melted together and applied hot to the perfectly dry wood. Do not use zinc.

(2192) L. P. L. asks: With what force will a body weighing 150 pounds strike a jumping net, falling from a height of 45 feet, and how many men will it take to hold the net? Size of net 10 feet in diameter, woven like a spider's web. Body falling from natural gravity. A. The body will touch the net with a velocity of $53\frac{8}{10}$ feet per second, and evolve a force of 4 foot tons, or 8,000 pounds through a space of 1 foot. If its fall is stopped in a distance of 3 feet after touching the net, the final weight of impact on the net will be 2,666 pounds. It will take more men than can grab the net to stop the fall.

(2193) Subscriber asks: Which is the more economical for feeding a 40 horse power tubular boiler, a power or steam pump, and why? Said pump to be used for nothing else, and all the water to go through a heater, warmed by the exhaust from the engine. Steam pressure on boiler, from 80 to 90 pounds. A. The power pump is the most economical, because the engine, if a good one, is more economical than a pump for a given power. In the steam pump the steam follows full stroke, while the steam engine utilizes the economy of expansion and has also less clearance than a steam pump, and a less per cent of friction.

(2194) S. P. C. asks how to prepare glue size in liquid form to keep fluid at 34° to 40° above zero. I want to use it with resin and wood alcohol to fill a paper surface. A. Mix your glue after solution in water with vinegar or nitric acid. Try first an equal measure of strong vinegar. If insufficient, add some nitric acid.

(2195) E. L. asks: Is there any way whereby the quicksilver can be restored or the vacant spots restored where the quicksilver is off in spots on a mirror? A. Take a small fragment of mirror, put mercury on its back, push off the coating, and let it drop upon the spot, press with a piece of tin foil above it. Success is doubtful.

(2196) R. H. S. asks (1) the formula for fluid that will allow the zinc to be left in a one-fluid plunge battery when not in use. I have reference to a battery for running a small motor. A. Keep zincs thoroughly amalgamated. Even then they will be attacked except in caustic soda batteries. In latter amalgamation is not needed. 2. Any difference between chloride of lime and chloride of calcium? A. One consists of chlorine and calcium ($CaCl_2$), the other contains oxygen also ($CaCl_2O$ principally). 3. Is bichromate of soda better than bichromate of potash for a fluid in carbon battery? A. It does not form the troublesome chrome alum crystals. 4. How far would a body have to be from the earth so the attractions of sun and earth would attract it equally? What is the rule for the above query? A. In general terms the square of the distances from earth and sun should be directly as the weights of earth and sun.

(2197) A. H. A. asks how to plate with fourteen carat gold. A. If you will mix copper cyanide and gold cyanide solutions by varying the area of your anode, you may get an alloy deposit. Brass can be thus deposited. The color of the deposit is the only guide, and in your case this would be hardly available.

(2198) J. J. B. asks whether there is any plant or vegetable known to science that contains mercury in any shape or form. A. None is known. 2. And if there is any vegetable or plant that contains iron, and if so, to what extent? A. Nearly all contain traces of it.

(2199) F. A. K. asks: 1. What is terra japonica made of? A. It is an aqueous extract from the wood of the *Acacia catechu* (nat. ord. *Leguminosæ, Mimoseæ*). 2. Will it injure the iron or steel of steam boilers if used as a scale remover? A. No. 3. If it is not a good article for above purpose, what would you recommend? A. Carbonate of soda may be used if the other does not answer.

(2200) H. B. asks what the composition of oroide is, such as writing pens are made of, and how are such pens made.

A. Copper.... .....68·21 parts.
Zinc.....13·52 "
Tin..... 0·48 "
Iron..... 0·24 "

Pens are made from sheet metal by stamping.

(2201) R. H. D. asks for a formula for boiling meerschaum pipes. A. Heat wax up to boiling. Plug openings in pipe, and plunge it into wax for 1 minute. It should be done by an experienced person, as you may injure the pipe. Try your hand upon one of little value, as they often crack. Milk may be used instead of wax for slow coloring.

(2202) E. S. M. asks for a recipe for a black kalsomine, which, when applied to a white wall, will give a dull black. For one gallon soak ½ pound good glue in water, heat until dissolved, and dilute to one gallon. Mix with this lamp black, and if desired a little whiting to give it a body.

(2203) R. B. asks for a formula for a good furniture polish to use on furniture in use. A. Mix oil of amber (refined) and olive oil, 1 pound of each, with 1 ounce tincture of henna. 2. How to destroy water bugs and other insects that are in dwellings. A. Use fresh Persian powder; for water bugs use powdered borax.

(2204) A. B. S. asks: Will you kindly advise me by return mail if there are any two or three kinds of metal that will form an electric current when brought in contact with each other? A. Practically no.

(2205) L. A. J. asks for a receipt for making waterproof cement, to be used in constructing aquarium. A. Take 25 parts gutta percha in shreds and melt it carefully. Add 75 parts ground pumice stone, and then mix in 150 parts Burgundy pitch and melt well together.

(2206) E. W. M. asks: 1. Can No. 24 cotton-wound copper wire be used for the secondary coil of an induction coil? If it can, what should I use for the primary coil? Also, how much tin foil is necessary for the condenser of such a coil? A. Wire of this size is not suitable for a spark coil. No. 36 should be used. Two layers of No 16 would answer for the primary of an induction coil 8 or 10 inches long. It requires from 30 to 40 square feet of tin foil for the condenser. 2. How many cells of Grenet battery are necessary to operate it (size of zinc and carbons 4¾ by 1⅜ in.)? A. From 4 to 6, connected two in parallel. 3. Can No. 24 wire be used on a small electric locomotive like the one in SUPPLEMENT, No. 19, page 301? A. Yes. 4. How many Grenet cells are needed to run a locomotive so made, the track being of copper and about five feet in diameter? A. Two or three. 5. What is a good formula for blue prints on rough drawing paper? A. For information on blue prints consult SUPPLEMENT, Nos. 585 and 514.

(2207) H. H. G. says: I would like you to explain in the SCIENTIFIC AMERICAN why the moon which fulled on April 5 was so late in getting up? On the 1st of the month it did not rise until 23.45, when, according to the N. W. Almanac, it was due at 20.8. It has caused considerable comment about here, as moons at that stage rise so much earlier than this one. A. On April 7 the moon rose at 21 h. 9 m. by our almanac. The moon is generally very steady in her habits of rising and setting. Mankind and their time keepers are not so steady.

(2208) W. L. asks: 1. Would a cast iron ring two inches diameter, two and one-half inches wide and one-fourth inch thick, do for an armature core for a small electric motor, or would it not be thick enough? A. Better use a ring formed of wire. Cast iron will not answer well in this place. A. Please tell me what these "fire eaters" use and how they use? Something which they blow out of their mouth, which will ignite by a flame? A. A piece of lamp wick an inch long is soaked in nitrate of soda solution. This is lighted and embedded in tow, which is held in the mouth. By blowing through this or by closing the mouth on it, the effects can be produced. 3. What elements does the new Edison battery contain, and what solution? A. Zinc and solidified black oxide of copper. The solution is caustic potash and water. 4. If a current of 110 volts be passed through a rheostat, which will be reduced—the volts or the amperes? A. The amperes. 5. Why is it that if a current be turned on to a motor too quickly, it will burn the armature out? A. Because the resistance of still or slow-moving motor is so small as to allow too much of the current to pass.

(2209) S. B. asks: Is hypnotism a humbug or not? A. Hypnotism is a legitimate subject of study for scientists. It is still a subject of investigation, and no very definite conclusions have been reached. Those who lay claim to an occult knowledge of it may generally be set down as impostors.

(2210) R. M. N. asks: 1. Please give the method of embalming flowers, and chemicals used? A. As generally executed, embalming flowers consists in making wax imitations or copies, and this is really the best approach to the real thing. No good embalming process has been discovered applicable in all cases. 2. Give process of making India ink. A. It is made from fine lampblack compacted and cemented with glue. The finest black is said to be derived from pork fat. The glue is made from Buffalo hide. The process is described in "Workshop Receipts," 2d series, p. 335. 3. Which moves more easily on a plane—a large or small wheel? A. A large wheel. 4. Can fish be drowned? If so, under what circumstances? A. Yes; if the action of their gills is disturbed or interfered with.

(2211) S. B. asks: 1. How to temper a drill so it would be hard enough to drill holes in glass? A. A drill heated to a low red, and plunged in a strong solution of chloride of zinc, will drill glass. 2. Also where can I obtain a book that treats entirely on electricity, so as to enable me to work on electricity or to experiment on various subjects? A. "Experimental Science" will probably meet your wants, although it does not treat solely the subject of electricity.

(2212) J. C. B. says: A dispute arose lately upon which I wish your opinion. A 3 inch safety valve has an outlet or a waste pipe of 3 inches in diameter. As the safety valve is weighted at 100 pounds to the square inch, one person contends that a 2 inch waste pipe will give abundant outlet. Others contend that the waste pipe should be of the full dimension of the orifice of the safety valve. As the steam exhausts into the atmosphere against 15 pounds to the square inch, it seems reasonable that a 2 inch waste pipe would give abundant room for all the steam to escape which would issue from a 3 inch aperture against a hundred pounds pressure. A. A 2½ inch outlet is generally used for a 3 inch safety valve, although a 2 inch outlet will discharge all the steam that will escape through a 3 inch valve as ordinarily used. The construction of safety valves does not admit of their full opening, seldom more than one tenth their capacity when opened under boiler pressure.

(2213) W. R. writes: I have 30 cells of gravity battery, each cell having an E. M. F. of 1 volt; would above mentioned battery do for electric lighting, and what candle power lamp would it supply? Would it be as good for the purpose, and give the same amount of current, as 15 cells of bichromate of potash battery, each cell having an E. M. F. of 2 volts? A. Owing to the great resistance of the gravity battery, it is not adapted to electric lighting purposes. By applying Ohm's law, you will readily see the difference between the two batteries. Thirty cells of gravity battery would have a resistance of 90 ohms at least. A 30 volt lamp has a resistance of 25 ohms. The least possible total resistance would therefore be 115 ohms. According to Ohm's law $\frac{E}{R} = C$ we will have $\frac{30}{115} = 0{\cdot}26$ ampere. The lamp requires a current of 1·20 amperes. Under the same conditions the bichromate battery would yield a current of 0·92, which is about 3½ times greater than that from the gravity battery, but still insufficient for a single 30 volt lamp.

(2214) J. E. F. L. asks: What is the desired object to be attained in "squaring the circle"? A. It resolves itself into finding the ratio between circumference and radius. The original idea was to describe a square of area equal to a circle.

(2215) W. M. D. writes: Can you tell me of some plan for preventing the green stains on marble caused by water dripping from a bronze tablet? We have a soldiers' monument with a bronze tablet let into each of its four faces, and the marble below the tablets is streaked with green. I would like to know how to remove the stains and to prevent the formation of more in the future. A. Treat the stains by process given in query 2176. When the marble is clean, go over it with hot paraffin. The cure will not be a perfect one.

(2216) C. F. T. writes: 1. Is there any way I could stain or color a white glass bottle to a deep ruby color? A. Mix clear dammar varnish with red extract of alkanet root and varnish the bottle. 2. How can I smooth the inside of a piece of half inch gas pipe about 3½ ft. long? I have neither drill nor reamer long enough. A. Only by mechanical means, such as a stick coated with glue and emery. The operation may prove a long one.

(2217) F. E. K. J. asks: How can I make a fluid like binders use in ruling letter paper? I made same with aniline and water, but it seemed to flow too freely. A. Add a little gum arabic solution to your ink. Aniline will fade. A dilute solution of sulphindigotic acid with gum arabic would be more permanent.

(2218) W. H. writes: Every week I receive an English paper containing an advertisement wherein the word "patentor" occurs. I am unable to find authority for the word. Will you kindly inform me if it is proper, and if so, why is it not generally used? A. Patentee means one who has patented, and is applicable to all recipients of patents. Patentor indicates one who is engaged in patenting, and while it could be used in the other sense, seems to present no particular advantage, and certainly lacks authority.

(2219) G. H. S. asks: If there is any fluid or liquid in existence which always remains the same in weight and quantity, and which climate has no influence on. A. Probably mercury comes the nearest to your requirements; glycerine, or a non-drying oil, such as olive or sweet almond oil, approximate thereto.

(2220) W. H. O. writes: Is there any difference in the degree or extent to which water and (or) oil may be reduced in bulk by forcible compression under the air pump or otherwise? A. Each fluid has its own coefficient of reduction or expansion under changes of pressure.

(2221) O. O. asks: How is it that telegraph lines make a musical sound when there is no perceptible breeze blowing? A. There seem to be particular directions and strengths of wind that correspond with the natural vibration period of the wires. A strong wind out of accord may have little effect, where a slight wind in accord has a powerful effect.

(2222) A. W. G. asks: 1. A current of electricity is said to flow, always, from the positive to the negative pole when they are connected by a conductor. If this is correct, how, in working a differential duplex, with the positive pole of the battery to the ground and the negative to the line, can the current divide at the relay so as to pass through both coils? A. A current always divides in a branched circuit in proportion to the conductivity of the different branches. 2. What is meant by "counter electromotive force," spoken of in connection with electric light circuits? A. Counter electromotive force in arc light circuits is due to polarization in the lamps. It is a current which opposes the direct current by which the arc is produced.

(2223) J. B. asks (1) for the formula to apply to the tin in making tin types. The formula and process of developing and finishing. A. The plate is coated with a collodion made as follows, but which can be bought at photo dealers ready made:

Collodion.

Alcohol and ether equal parts, gun cotton sufficient to make moderately thick film, say 5 or 6 grains to the ounce, put the cotton in the ether first, when it is well saturated pour in the alcohol, to which add

Iodide of ammonium.....4 grs. to the oz.
Iodide of cadmium..... 2 " " " "
Bromide of cadmium... .....1 " " " "
Bromide of copper..... 1 " " " "

There are 8 grains of salt to the ounce. When the collodion has set, the plate is immersed in a silver bath, made by dissolving 50 grains of nitrate of silver in 1 ounce of distilled water, and kept there from 2 to 5 minutes. It is then put into a plate holder, exposed for 29 seconds in the camera, and developed with the following:

Developer.

Water ....64 oz.
Protosulphate of iron..... ..... 4 "
Acetic acid..... 4 "
Alcoholic solution of tannin, ten grains to the ounce..... ..... 4 "

The acid and tannin solutions should be added after iron has been dissolved. The developer has to be flowed over the plate with one sweep. The picture is fixed by putting the plate into

Cyanide of potassium..... 2 oz.
Water..... 64 "

Then washed and dried. We obtain the above particulars from "Photography in the Studio," by E. M. Estabrook. 2. Will the diaphragm in the telephone in the December number work better to be of larger diameter? A. No.

(2224) H. R. N. writes: I have made simple electric motor described in SUPPLEMENT, No. 641. It runs finely when connected as a shunt machine on Edison current of 110 volts. 1. Can I run it with the caustic potash battery described on page 408 of "Experimental Science"? A. You can run your motor with the caustic potash battery, but it will require about 20 cells connected, 5 in parallel, and 4 in series. 2. How many cells and what size should they be to run a boat 15 feet long, 3 feet broad? I have motor wound with No. 20 wire, 100 feet on each magnet coil. A. For running a boat you would require a more compact battery. Better use a plunging bichromate battery of 6 to 8 cells, with carbon and zinc plates 6×8 inches. 3. What size propeller will I need to run the boat at a fair speed? A. You would require a two-bladed propeller 8 inches in diameter.

(2225) R. A. writes: 1. I should like to know why they use permanent magnets in the telephone now in general use. A. Permanent magnets are used in telephones to avoid the necessity of a battery, involving expense and trouble. 2. A telephone man told me that it was necessary to have the receivers exactly equal, that is, have the same size coil, core, and tympanum. Is this true, and why? A. It is not true. 3. If brass is made of copper and zinc, does it form a battery when placed in acid and water, and is that the reason it makes a sore on the flesh by decomposing the fluids, and they claim it cures rheumatism? A. It may dissolve, but forms no galvanic couple properly speaking. It makes a sore by the poisonous action of the oxidizing copper. 4. What is German silver? A. An alloy of copper, nickel, and zinc. 5. Are there more amperes given by a number of cells connected in multiple than one cell with an equal surface of carbon and zinc? A. The same current, other things being equal. 6. Is the chemical action of dry batteries the same as others, and why can it be restored by reversing a current through it? A. Yes; almost any battery can be restored more or less as described. 7. I find that in a pair of electric horseshoe magnets, as long as there is a good connection between the two poles by an iron armature, the magnetism remains after the current has ceased, this is only when there is a clean connection. If paper or any non-magnetic metal comes between, it ceases. I have never seen it mentioned in any electrical books.

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What and why is it? A. The paper breaks what may be termed the magnetic circuit. 8. How can wood be seasoned? A. By drying. 9. Why do they use an induction coil in the telephone instead of a direct current? I should think it would be unprofitable on account of the resistance. A. To avoid the necessity for heavy lines for conductors.

(2226) A. T. O. writes: 1. I have a solid flame gas furnace. Is it a good thing to use in heating tool steel for forging and tempering? A. Yes, if the temperature is high enough. 2. What is the caustic potash and iron battery of which I have heard favorable mention lately? A. Negative element iron, positive element zinc, depolarizer oxide of copper, resting on the iron plate, exciting liquid caustic soda, or caustic potash in solution, E. M. F. 0·7 to 0·9 volt. Resistance very low, current very constant. 3. A ton of water falling 10 feet will do 20,000 foot pounds of work. Now, I maintain that if it be allowed to do its work by falling through that distance, it is immaterial whether it does it through the medium of an overshot or a turbine wheel, provided friction be left out of account, and, in the case of the overshot, that none of the water be discharged from the buckets until it reaches the lower level. Am I right? A. It is immaterial. On the whole perhaps the overshot type of wheel has given the highest efficiency, though turbines have in some instances given about as good results. A loss of from 10 to 30 per cent is to be anticipated.

(2227) L. H. asks: How many gallons of water can be evaporated with a ton of coal? Does salt water evaporate as fast as fresh, under similar conditions, and if not, explain difference? What is the best known process for evaporating water for making salt where coal is used as a fuel, and where can I get information as to the cost of same? A. The evaporation power of a ton of bituminous coal is equal to about 3,000 gallons of water in open pans, with economical firing. As saturated brine boils at 227° Fah., instead of 212° for fresh water, the evaporation effect of a ton of coal will be somewhat less for making salt. By the regenerative process of utilizing the heat of the vapor of evaporation for heating and concentrating the incoming brine, it is claimed that a much greater evaporation effect is produced per pound of coal, a possibility of nearly 15 pounds of water per pound of coal. By addressing the Secretaries of State of New York and Michigan you may obtain the reports on the salt industry of these States.

(2228) W. D. M. asks: 1. What is the E. M. F. of Fuller's battery? A. About 2 volts. 2. How long will 10 or 12 Fullers run, using them about four to six hours a day? A. It depends on the amount of work done. Probably 4 or 5 days. 3. How many 2 quart Bunsen battery cells will it take to run the simple electric motor, and how many days will they run the motor at six hours a day? A. It will take 12 cells, connected 6 in parallel and 2 in series. 4. Will wrought iron do to wind the field magnet on? A. Yes. 5. Can I use wrought iron for the core of the armature? A. It is not as good as the wire. 6. Can I use insulated iron wire No. 19 to wind the core of the armature? A. Yes. 7. What number of wire should be used for the winding of armature and field magnet? A. No. 18. 8. How many revolutions will it make a minute? A. About 2,500. 9. What fraction of a horse power is it? A. One-eighth to one-tenth.

(2229) J. B. P. asks: Why does a tree grow round and not square or any other shape? A. There is nothing in nature on the square, except the forms of some crystalline minerals. A circle is the shortest way around, and as trees grow from a common center, a circle becomes a natural sequence in their outward form.

(2230) E. H. asks: Is there any agent known which will restore the ductility of sheet iron, which has been annealed, otherwise than rolling? A. Rolling or hammering is the only way of hardening zinc. Its toughness cannot be restored except by rolling at the proper temperature.

(2231) O. P. Q. asks for a rule to find the horse power to hoist a given load from a coal shaft in a given time. Say 2,500 pounds 400 feet in one minute. A. Multiply the load in pounds by the height in feet per minute and divide the product by 33,000. Thus: $\frac{2500\times400}{33000}$ = 30 horse power, to which must be added the friction of engine and hoisting gear.

(2232) G. W. T. asks: What is the difference in amount of yearly evaporation between one acre of grass land, one acre of plowed land, and one acre of water? A. The difference between the amount of evaporation on water, plowed land, and grass is very uncertain, depending upon the supply of water in the soil, a dry soil evaporating much less than a wet soil under plowed ground. On the average, evaporation on water is greatest, amounting to about 0·08 of a pound per square foot per hour at a temperature of 50° in a light breeze. Plowed ground less, and grass more or less, according to condition of soil beneath. The river basins of the northeastern part of the United States and Western Europe evaporate about one-half the total rainfall, while the great basins of the Amazon and the Mississippi evaporate four-fifths of the total rainfall. The entire Nile basin evaporates about 96 per cent of the total rainfall. The evaporation from the whole land surface of the world gives an average of about 75 per cent of the total rainfall upon the land.

(2233) W. E. F.—The bird is the Bohemian waxwing (*Ampelis garrulus L.*) Habitat North America, U. S. "Casually in winter, but sometimes appearing in immense roving flocks south, sometimes to 35°" (Coues); also "Northerly hemisphere, northerly, wandering south in vast troops at irregular periods. In America, south, regularly in winter to the northern tier of States, in the Rocky Mountains much further, casually to about 35°. Rare on the Pacific coast except in Alaska. Breeds in high latitudes, but down to the United States border in the Rocky Mountains nests in trees or bushes in the crotch of a bough or saddled on a limb" (Coues). Eggs larger than those of the cedar waxwing. Your other queries will be answered later.

(2234) C. H. V. asks: What will make linen paper soft and limber, other than by immersion in weak sulphuric acid bath? A. Boiling water tends to produce the desired effect; caustic alkali in solution or a strong solution of chloride of zinc may be tried. It is not easy to suggest anything that will effect the purpose without injury to the fiber.

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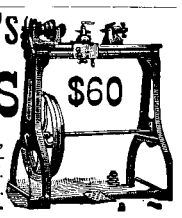

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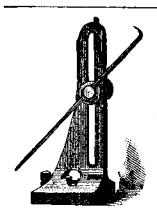

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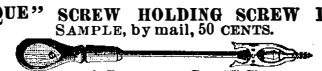
50c.  50c.
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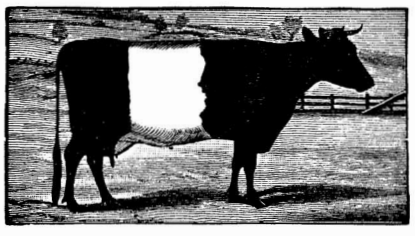

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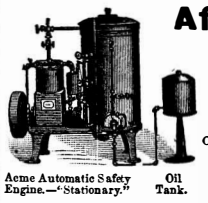

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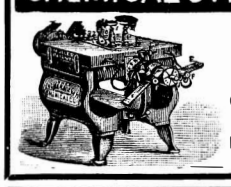

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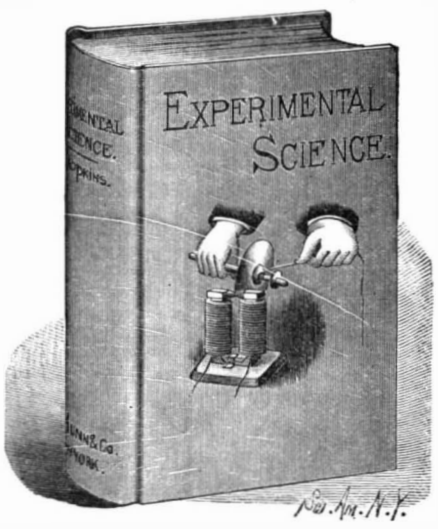

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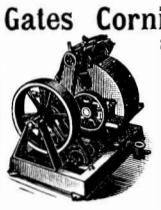

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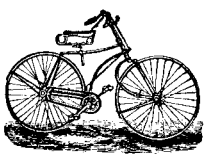

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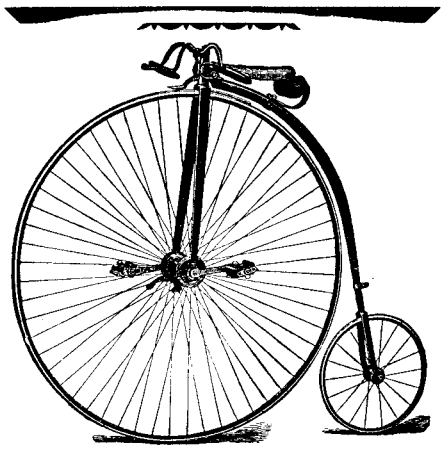

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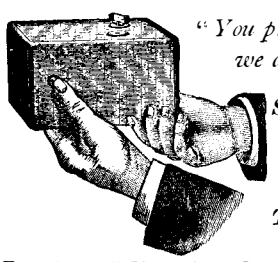

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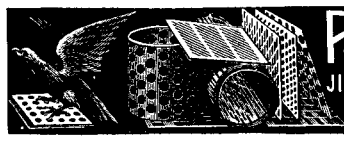

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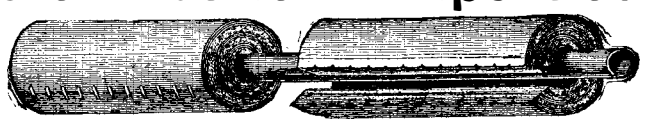

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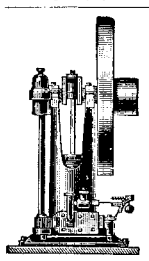

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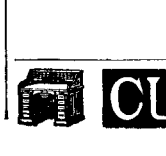

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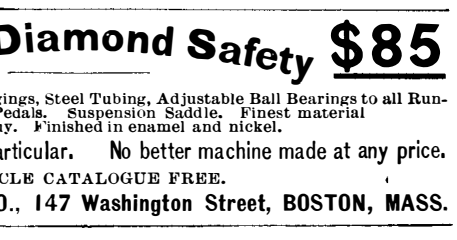

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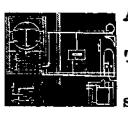

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